Industrial Gigabit Ethernet Switch

IE-SW-PL18M Series Manual

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Weidmüller

Industrial Gigabit Ethernet Switch
IE-SW-PL18M Series Manual

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Contact Information

Weidmüller Interface GmbH & Co. KG
Postfach 3030
32760 Detmold
Klingenbergstraße 16
32758 Detmold
Germany

Phone +49 (0) 5231 14-0
Fax +49 (0) 5231 14-2083
E-Mail info@weidmueller.com
Internet www.weidmueller.com

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Introduction

The Managed Gigabit Ethernet Switches of the IE-SW-PL18M Series are especially designed for connecting Ethernet-enabled devices in industrial field applications.

The following topics are covered in this chapter:

- **Overview**
- **Package Checklist**
- **Features**

Overview

As the world's network and information technology becomes more mature, the trend is to use Ethernet as the major communications interface in many industrial communications and automation applications. In fact, a whole new industry has sprung up to provide Ethernet products that comply with the requirements of demanding industrial applications.

IE-SW-PL18M switch is designed for Gigabit-speed, high port density, ultra-reliable operation in rugged industrial environments, and is therefore the best choice for each industrial application.

Package Checklist

The Ethernet Switch IE-SW-PL18M Series is shipped with the following items. If any of these items are missing or damaged, please contact your customer service representative for assistance.

- 1 Ethernet Switch IE-SW-PL18M.
- Hardware Installation Guide.
- CD-ROM with User's Manual and Windows Utility.
- RJ45 to DB9 Console port cable.
- Protective caps for unused ports.

Features

- IPv6 Ready logo awarded (IPv6 Logo Committee certified).
- IEEE 1588 PTP (Precision Time Protocol) for precise time synchronization of networks.
- DHCP Option 82 for IP addresses assignment with different policies.
- Modbus/TCP industrial Ethernet protocol supported.
- Turbo Ring and Turbo Chain (recovery time < 20 ms at full load) and RSTP/STP (IEEE 802.1w/D).
- IGMP snooping and GMRP for filtering multicast traffic.
- Port-based VLAN, IEEE 802.1Q VLAN, and GVRP to ease network planning.
- QoS (IEEE 802.1p/1Q) and TOS/DiffServ to increase determinism.
- Port Trunking for optimum bandwidth utilization.
- IEEE 802.1X, HTTPS, and SSH to enhance network security.
- SNMPv1/v2c/v3 for different levels of network management.
- RMON for efficient network monitoring and proactive capability.
- Bandwidth management prevents unpredictable network status.
- Lock port function for blocking unauthorized access based on MAC address.
- Port mirroring for online debugging.
- Automatic warning by exception through e-mail, relay output.
- Digital inputs to integrate sensors and alarms with IP networks.

2

Getting Started

This chapter explains how to access IE-SW-PL18M for the first time. There are three ways to access the switch: serial console, Telnet console, and web browser. The serial console connection method, which requires using a short serial cable to connect the IE-SW-PL18M to a PC's COM port, can be used if you do not know the IP address of the switch.. The Telnet console and web browser connection methods can be used to access the IE-SW-PL18M over an Ethernet LAN, or over the Internet.

The following topics are covered in this chapter:

- **RS-232 Console Configuration (115200, None, 8, 1, VT100)**
- **Configuration using a Telnet Console**
- **Configuration using a Web Browser**
- **Disabling Telnet and Browser Access**

RS-232 Console Configuration (115200, None, 8, 1, VT100)

NOTE Connection Caution!

1. You cannot connect to the IE-SW-PL18M simultaneously by serial console and Telnet.
2. You can connect to the IE-SW-PL18M simultaneously by web browser and serial console, or by web browser and Telnet. However, we strongly suggest that you do NOT use more than one connection method at the same time. Following this advice will allow you to maintain better control over the configuration of your IE-SW-PL18M.

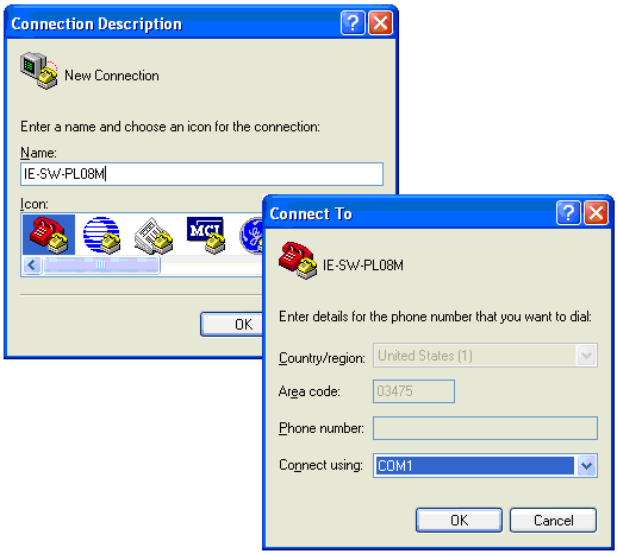
NOTE We recommend using Hyper Terminal Program, which is already installed under Windows XP operating system.

Before running Hyper Terminal Program, uses an RJ45 to DB9-F (or RJ45 to DB25-F) cable to connect the Ethernet Switch's RS-232 Console port to your PC's COM port (generally COM1 or COM2, depending on how your system is set up).

After starting Hyper Terminal Program, perform the following steps to access the RS-232 Console utility.

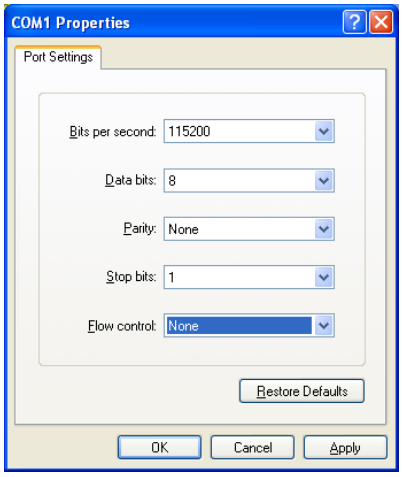
1. From the Windows desktop, click **Start → Programs → Accessories → Communications → Hyper Terminal.**

2. Start Hyper Terminal and enter a name of your choice for the new connection. Select the appropriate COM port for console connection in the "New Connection" window.

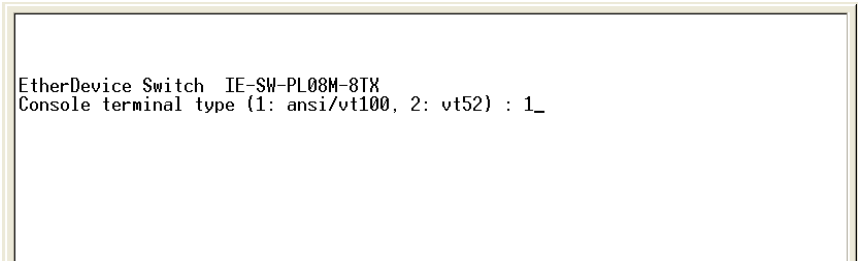


3. The **Communication Parameter** for console connection are:

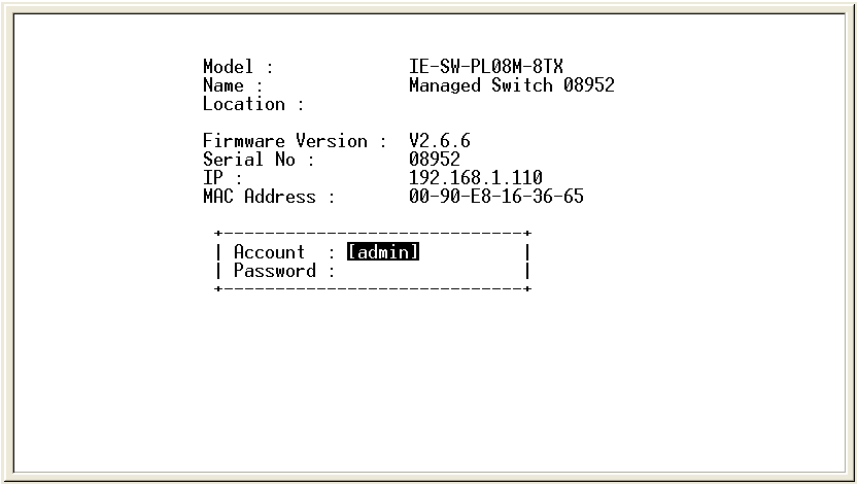
   115200 for **Baud Rate**, **8** for **Data Bits**, **None** for **Parity**, **1** for **Stop Bits,** and **None** for **Flow control**. Click **OK** to continue.



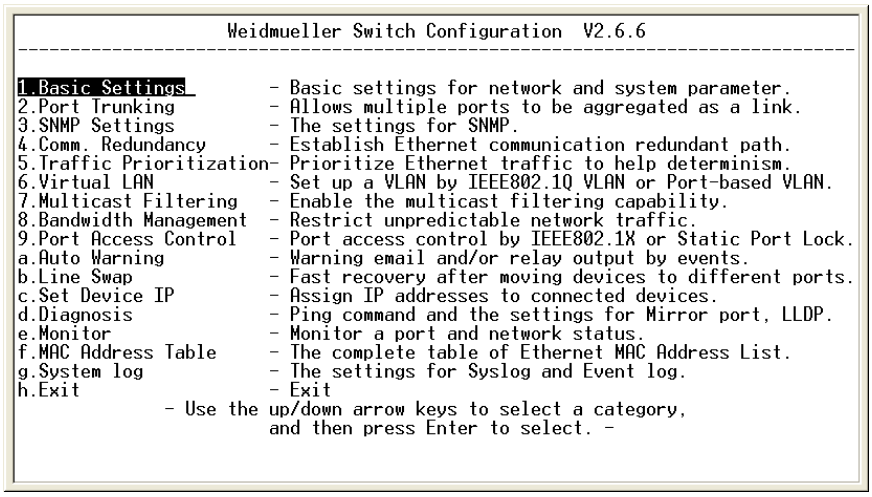
4. Type **1** to select **ansi/VT100** terminal type, and then press **Enter**.



5. The Console login screen will appear. Press **Enter** to open the Account pop-up selector and then select either **admin** or **user**. Use the keyboard's down arrow to move the cursor to the Password field, enter the default **Console Password "Detmold"** (this is the same as the Web Browser password; leave the **Password** field blank if a console password has not been set), and then press **Enter**.



6. The IE-SW-PL08M's **Main Menu** will be displayed.


Weidmueller Switch Configuration V2.6.6
1.Basic Settings - Basic settings for network and system parameter.
2.Port Trunking - Allows multiple ports to be aggregated as a link.
3.SNMP Settings - The settings for SNMP.
4.Comm. Redundancy - Establish Ethernet communication redundant path.
5.Traffic Prioritization- Prioritize Ethernet traffic to help determinism.
6.Virtual LAN - Set up a VLAN by IEEE802.1Q VLAN or Port-based VLAN.
7.Multicast Filtering - Enable the multicast filtering capability.
8.Bandwidth Management - Restrict unpredictable network traffic.
9.Port Access Control - Port access control by IEEE802.1X or Static Port Lock.
a.Auto Warning - Warning email and/or relay output by events.
b.Line Swap - Fast recovery after moving devices to different ports.
c.Set Device IP - Assign IP addresses to connected devices.
d.Diagnosis - Ping command and the settings for Mirror port, LLDP.
e.Monitor - Monitor a port and network status.
f.MAC Address Table - The complete table of Ethernet MAC Address List.
g.System log - The settings for Syslog and Event log.
h.Exit - Exit
- Use the up/down arrow keys to select a category,
and then press Enter to select. -

7. After entering the **Main Menu**, use the following keys to move the cursor, and to select options.

Key	Function
Up/Down/Left/Right arrows, or Tab	Move the onscreen cursor
Enter	Display & select options
Space	Toggle options
Esc	Previous Menu

Configuration using a Telnet Console

You may use Telnet to access the IE-SW-PL18M's console utility over a network. To be able to access IE-SW-PL18M's functions over the network (by Telnet or Web Browser) from a PC host that is connected to the same LAN as the switch, you need to make sure that the PC host and the IE-SW-PL18M are on the same logical subnet. To do this, check your PC host's IP address and subnet mask. By default, the IE-SW-PL18M's IP address is 192.168.1.110 and the subnet mask is 255.255.255.0 (for a Class C network). If you do not change these values, and your PC host's subnet mask is 255.255.255.0, then its IP address must have the form 192.168.1.xxx.

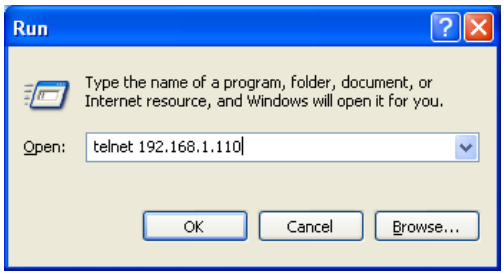
NOTE To use the IE-SW-PL18M's management and monitoring functions from a PC host connected to the same LAN as the switch, you must make sure that the PC host and the IE-SW-PL18M are on the same logical subnet.

NOTE Before accessing the console utility by Telnet, first connect one of the IE-SW-PL18M's RJ45 Ethernet ports to your Ethernet LAN, or directly to your PC's Ethernet card (NIC). You can establish a connection with either a straight-through or cross-over Ethernet cable.

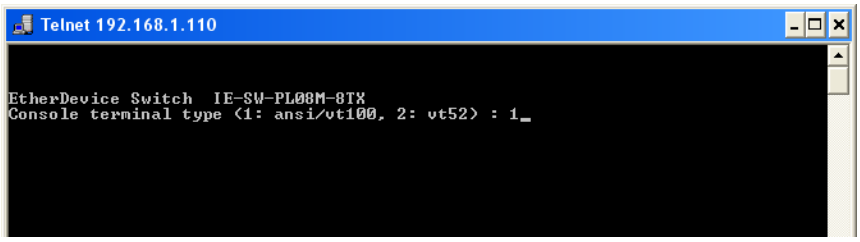
NOTE The IE-SW-PL18M's default IP is 192.168.1.110.

Perform the following steps to access the console utility by Telnet.

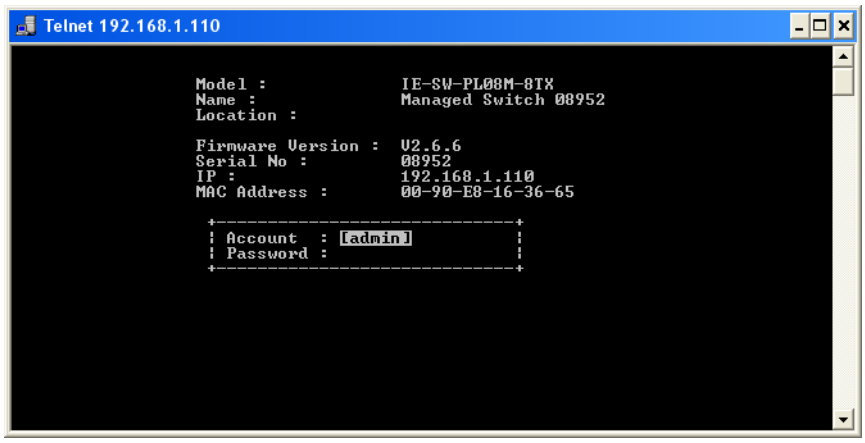
1. Click **Start → Run**, and then telnet to the Ethernet Switch's IP address from the Windows **Run** window. (You may also issue the telnet command from the MS-DOS prompt.)



2. Type **1** to choose **ansi/vt100**, and then press **Enter**.



3. The Console login screen will appear. Press **Enter** to open the Account pop-up selector and then select either **admin** or **user**. Use the keyboard's down arrow to move the cursor to the Password field, enter the **Console Password** (this is the same as the Web Browser password; leave the **Password** field blank if a console password has not been set), and then press **Enter**.



NOTE The Telnet Console looks and operates in precisely the same manner as the RS-232 Console.

Configuration using a Web Browser

The IE-SW-PL18M's web browser interface provides a convenient way to modify the switch's configuration and access the built-in monitoring and network administration functions. The recommended web browser is Microsoft Internet Explorer 5.5 or higher with JVM (Java Virtual Machine) installed.

NOTE To use the IE-SW-PL18M's management and monitoring functions from a PC host connected to the same LAN as the switch, you must make sure that the PC host and the IE-SW-PL18M are on the same logical subnet.

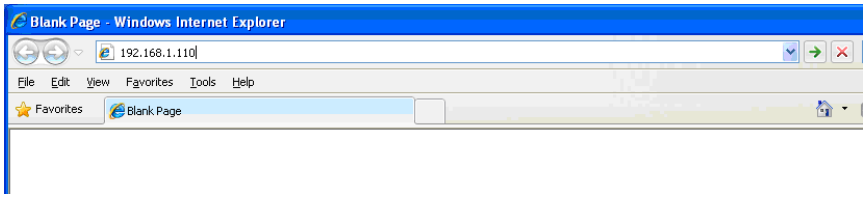
NOTE If the IE-SW-PL18M is configured for other VLAN settings, you must make sure your PC host is on the management VLAN.

NOTE Before accessing the IE-SW-PL18M's web browser interface, first connect one of its RJ45 Ethernet ports to your Ethernet LAN, or directly to your PC's Ethernet card (NIC). You can establish a connection with either a straight-through or cross-over Ethernet cable.

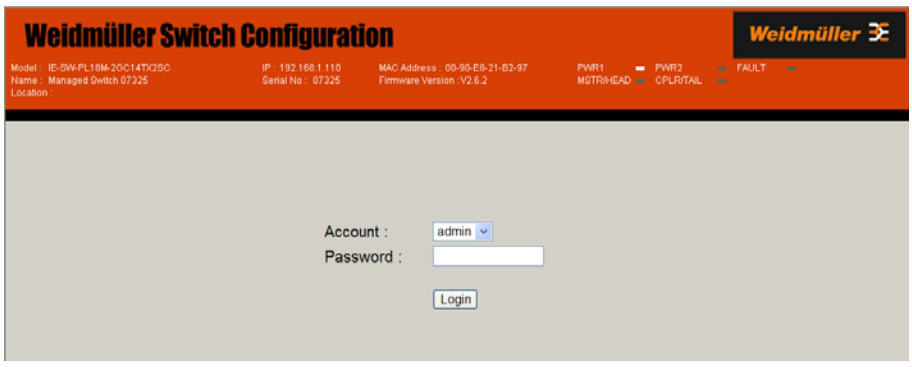
NOTE **The Weidmüller IE-SW-PL18M's default IP address is 192.168.1.110.**

Perform the following steps to access the IE-SW-PL18M's web browser interface.

1. Open Internet Explorer and type the IE-SW-PL18M's IP address in the **Address** field. Press **Enter** to establish the connection.

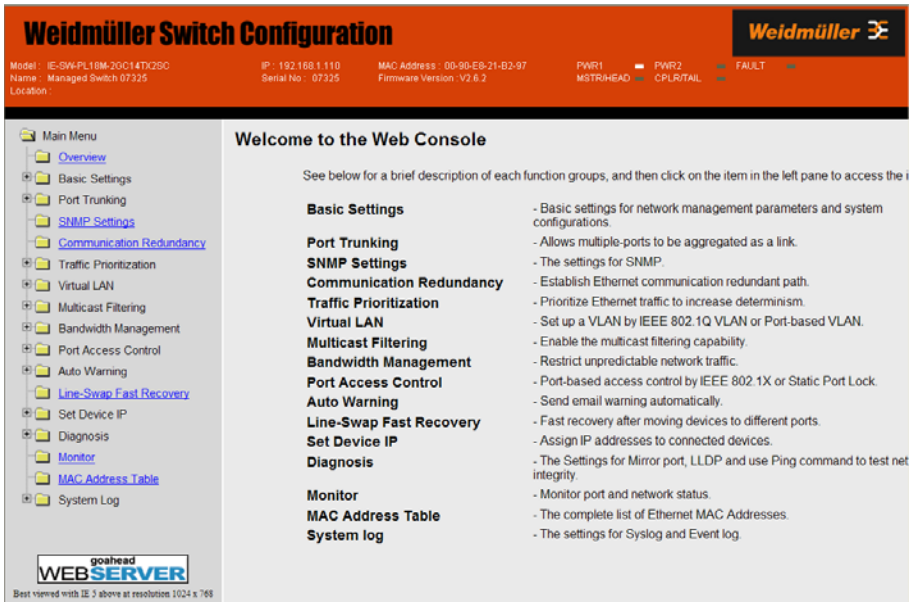


2. The web login page will open. Select the login account (Admin or User) and enter the default **Password** "Detmold" (this is the same as the Console password), and then click **Login** to continue. Leave the **Password** field blank if a password has not been set.



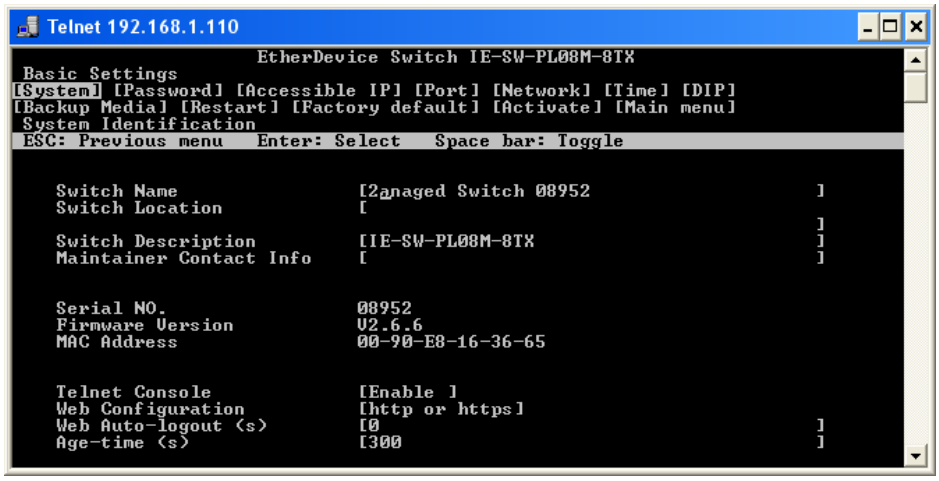
NOTE **By default, the IE-SW-PL18M's password is set to "Detmold"**

3. You may need to wait a few moments for the web page to be downloaded to your computer. Use the menu tree on the left side of the window to open the function pages to access each of Ethernet Switch's functions.


Weidmüller Switch Configuration
Weidmüller
Model : IE-SW-PL18M-2GC14TX2SC
Name : Managed Switch 07325
Location :
IP : 192.168.1.110
Serial No. : 07325
MAC Address : 00-90-E8-21-B2-97
Firmware Version : V2.6.2
PWR1
PWR2
FAULT
MSTR/HEAD
CPLR/TAIL
Main Menu
Overview
Basic Settings
Port Trunking
SNMP Settings
Communication Redundancy
Traffic Prioritization
Virtual LAN
Multicast Filtering
Bandwidth Management
Port Access Control
Auto Warning
Line-Swap Fast Recovery
Set Device IP
Diagnosis
Monitor
MAC Address Table
System Log
goahead
WEBSERVER
Best viewed with IE 5 above at resolution 1024 x 768
Welcome to the Web Console
See below for a brief description of each function groups, and then click on the item in the left pane to access the
Basic Settings - Basic settings for network management parameters and system configurations.
Port Trunking - Allows multiple-ports to be aggregated as a link.
SNMP Settings - The settings for SNMP.
Communication Redundancy - Establish Ethernet communication redundant path.
Traffic Prioritization - Prioritize Ethernet traffic to increase determinism.
Virtual LAN - Set up a VLAN by IEEE 802.1Q VLAN or Port-based VLAN.
Multicast Filtering - Enable the multicast filtering capability.
Bandwidth Management - Restrict unpredictable network traffic.
Port Access Control - Port-based access control by IEEE 802.1X or Static Port Lock.
Auto Warning - Send email warning automatically.
Line-Swap Fast Recovery - Fast recovery after moving devices to different ports.
Set Device IP - Assign IP addresses to connected devices.
Diagnosis - The Settings for Mirror port, LLDP and use Ping command to test net integrity.
Monitor - Monitor port and network status.
MAC Address Table - The complete list of Ethernet MAC Addresses.
System log - The settings for Syslog and Event log.

Disabling Telnet and Browser Access

If you are connecting the IE-SW-PL18M to a public network, but do not intend to use its management functions over the network, we suggest disabling both **Telnet Console** and **Web Configuration** from the RS-232 Console's **Basic Settings → System** page, as shown in the following figure.


Telnet 192.168.1.110
EtherDevice Switch IE-SW-PL08M-8TX
Basic Settings
[System] [Password] [Accessible IP] [Port] [Network] [Time] [DIP]
[Backup Media] [Restart] [Factory default] [Activate] [Main menu]
System Identification
ESC: Previous menu Enter: Select Space bar: Toggle
Switch Name [2anaged Switch 08952]
Switch Location [ ]
Switch Description [IE-SW-PL08M-8TX]
Maintainer Contact Info [ ]
Serial NO. 08952
Firmware Version V2.6.6
MAC Address 00-90-E8-16-36-65
Telnet Console [Enable]
Web Configuration [http or https]
Web Auto-logout (s) [0]
Age-time (s) [300]

3

Featured Functions

This chapter explains how to access the IE-SW-PL18M's various configuration, monitoring, and administration functions. There are three ways to access these functions: RS-232 console, Telnet console, and web browser. The serial console connection method, which requires using a short serial cable to connect the IE-SW-PL18M to a PC's COM port, can be used if you do not know the switch's IP address. The Telnet console and web browser connection methods can be used to access the IE-SW-PL18M over an Ethernet LAN, or over the Internet.

The Web Console is the most user-friendly way to configure the IE-SW-PL18M. In this chapter, we use the Web Console interface to introduce the functions. There are only a few differences between the Web Console, Serial Console, and Telnet Console.

The following topics are covered in this chapter:

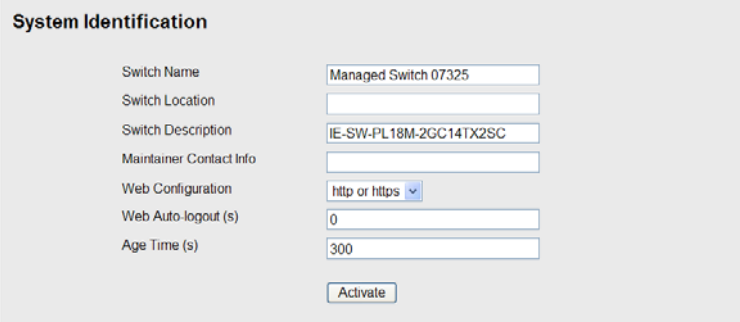
- **Configuring Basic Settings**
- **Using Port Trunking**
- **Configuring SNMP**
- **Using Communication Redundancy**
- **Using Traffic Prioritization**
- **Using Virtual LAN**
- **Using Multicast Filtering**
- **Using Bandwidth Management**
- **Using Port Access Control**
- **Using Auto Warning**
- **Using Line-Swap-Fast-Recovery**
- **Using Set Device IP**
- **Using Diagnosis**
- **Using Monitor**
- **Using the MAC Address Table**
- **Using System Log**
- **Using HTTPS/SSL**

Configuring Basic Settings

The Basic Settings group includes the most commonly used settings required by administrators to maintain and control the IE-SW-PL18M.

System Identification

The system identification items are displayed at the top of the web page, and will be included in alarm emails. Entering the system identification information makes it easier to identify the different switches connected to your network.



Switch Name

Setting	Description	Factory Default
Max. 30 Characters	This option is useful for specifying the role or application of different IE-SW-PL18M units. E.g., Factory Switch 1.	Managed Switch [Serial No. of this switch]

Switch Location

Setting	Description	Factory Default
Max. 80 Characters	To specify the location of different IE-SW-PL18M units. E.g., production line 1.	None

Switch Description

Setting	Description	Factory Default
Max. 30 Characters	Use this to enter a more detailed description of the IE-SW-PL18M.	IE-SW-PL18M

Maintainer Contact Info

Setting	Description	Factory Default
Max. 30 Characters	To provide information about whom to contact in order to resolve problems. Use this to enter contact information of the person responsible for maintaining this IE-SW-PL18M.	None

Web Auto-logout (s)

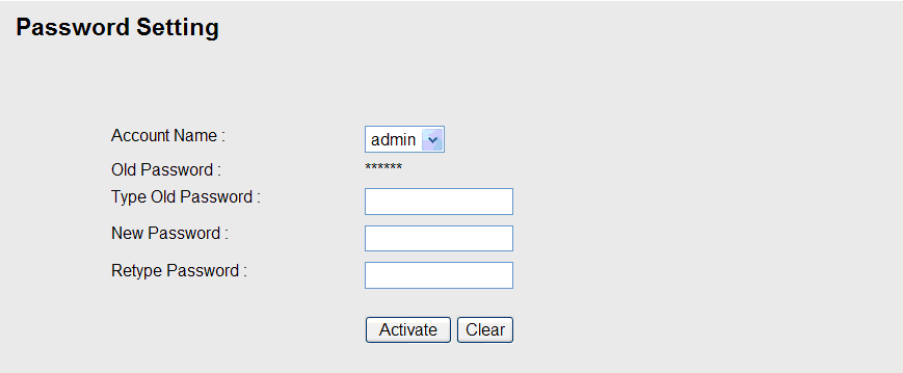
Setting	Description	Factory Default
60 to 86400 (seconds)	Disable or extend the auto-logout time for the web management console.	0 (disable)

Age time (s)

Setting	Description	Factory Default
15 to 3825 (seconds)	The length of time that a MAC address entry can remain in the Weidmüller switch. When an entry reaches its aging time, it "ages out" and is purged from the switch, effectively canceling frame forwarding to that specific port.	300

Password

The IE-SW-PL18M provides two levels of access privileges: **admin** privilege gives read/write access to all IE-SW-PL18M configuration parameters, and **user** privilege provides read access only. You will be able to view the configuration, but will not be able to make modifications.



ATTENTION

The IE-SW-PL18M's default Password is ”Detmold”. If this Password is changed, then you will be required to type the new Password when logging into the RS-232 Console, Telnet Console, or Web Browser interface.

Account

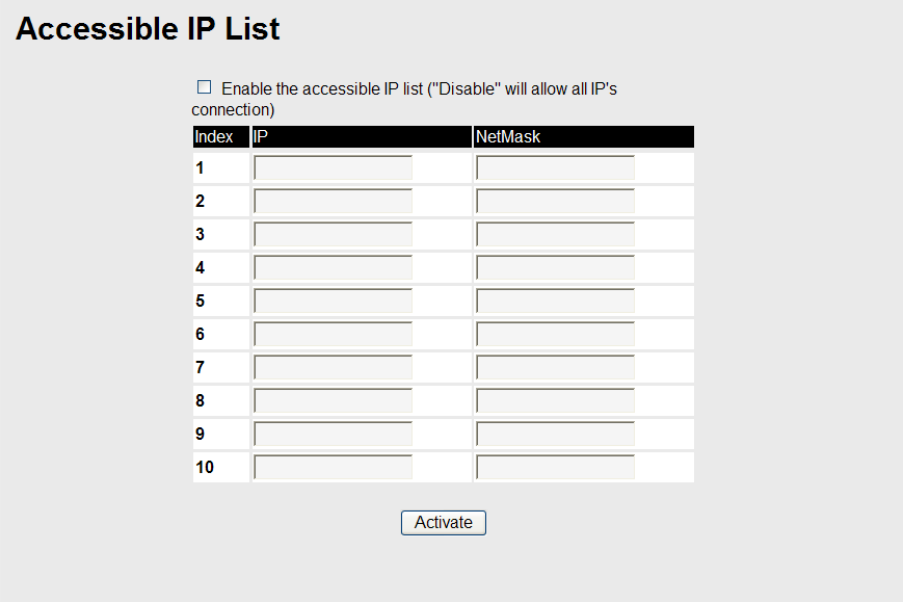
Setting	Description	Factory Default
admin	"admin" privilege allows the user to modify all IE-SW-PL18M configuration settings.	admin
user	"user" privilege only allows viewing the IE-SW-PL18M configurations.	

Password

Setting	Description	Factory Default
Old Password (Max. 16 Characters)	Type current password when changing the password	Detmold
New Password (Max. 16 Characters)	Type new password when changing the password	None
Retype Password (Max. 16 Characters)	If you type a new password in the Password field, you will be required to retype the password in the Retype new password field before updating the new password.	None

Accessible IP

The IE-SW-PL18M switch uses an IP address-based filtering method to control access to the device.



Accessible IP Settings allows you to add or remove "Legal" remote host IP addresses to prevent unauthorized access. Access to the IE-SW-PL18M is controlled by IP address. If a host's IP address is in the accessible IP table, then the host will be allowed access to the Ethernet switch. You can allow one of the following cases by setting this parameter:

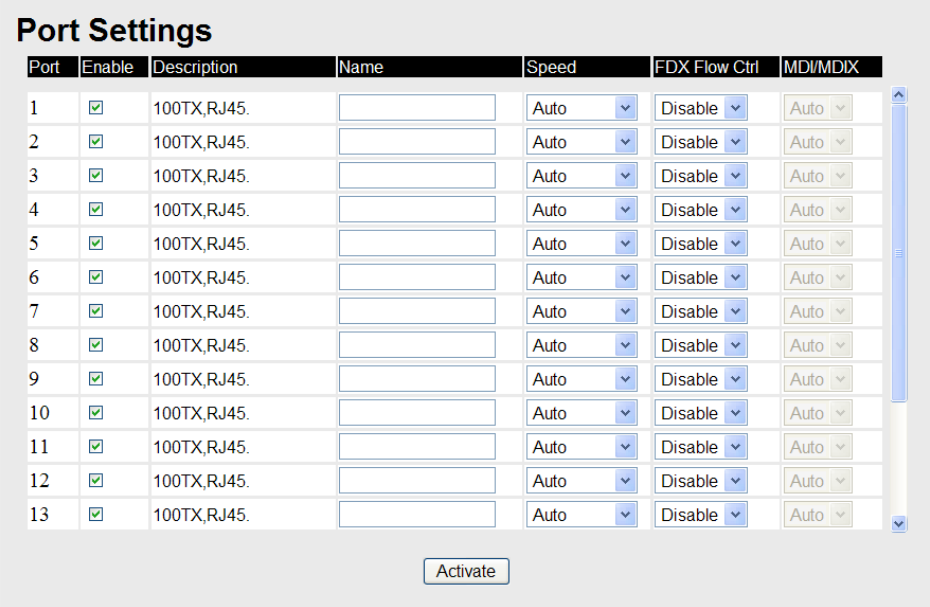
- **Only one host with the specified IP address can access the IE-SW-PL18M**
  E.g., enter "192.168.1.1/255.255.255.0" to allow access to *only* the IP address 192.168.1.1.
- **Any host on a specific subnetwork can access the IE-SW-PL18M**
  E.g., enter "192.168.1.0/255.255.255.0" to allow access to all IPs on the subnet defined by this IP address/subnet mask combination.

Any host can access the IE-SW-PL18M
Disable this function by deselecting the *Enable the accessible IP list* option.
The following table shows additional configuration examples:

Allowable Hosts	Input format
Any host	Disable
192.168.1.120	192.168.1.120 / 255.255.255.255
192.168.1.1 to 192.168.1.254	192.168.1.0 / 255.255.255.0
192.168.0.1 to 192.168.255.254	192.168.0.0 / 255.255.0.0
192.168.1.1 to 192.168.1.126	192.168.1.0 / 255.255.255.128
192.168.1.129 to 192.168.1.254	192.168.1.128 / 255.255.255.128

Port

Port settings are included to give the user control over Port Access, Port Transmission Speed, Flow Control, and Port Type (MDI or MDIX). An explanation of each configuration item follows:



Enable

Setting	Description	Factory Default
checked	Allows data transmission through the port.	enabled
unchecked	Immediately shuts off port access.	

ATTENTION

If a connected device or sub-network is wreaking havoc on the rest of the network, the **Disable** option under **Advanced Settings/Port** gives the administrator a quick way to shut off access through this port immediately.

Description

Setting	Description	Factory Default
Media type	Displays the media type for each module's port	N/A

Name

Setting	Description	Factory Default
Max. 63 Characters	Specify an alias for each port, and assist the administrator in remembering important information about the port. E.g., PLC 1	None

Speed

Setting	Description	Factory Default
Auto	Allows the port to use the IEEE 802.3u protocol to negotiate with connected devices. The port and connected devices will determine the best speed for that connection.	Auto
100M-Full	Choose one of these fixed speed options if the opposing Ethernet device has trouble auto-negotiating line speed.	
100M-Half		
10M-Full		
10M-Half		

FDX Flow Ctrl

Setting	Description	Factory Default
Enable	Enables flow control for this port when in auto-negotiate mode.	Disable
Disable	Disables flow control for this port when in auto-negotiate mode.	

The FDX Flow Ctr setting enables or disables the flow control capability of this port when the "port transmission speed" setting is in "auto" mode. The final result will be determined by the "auto" process between the IE-SW-PL18M and connected devices.

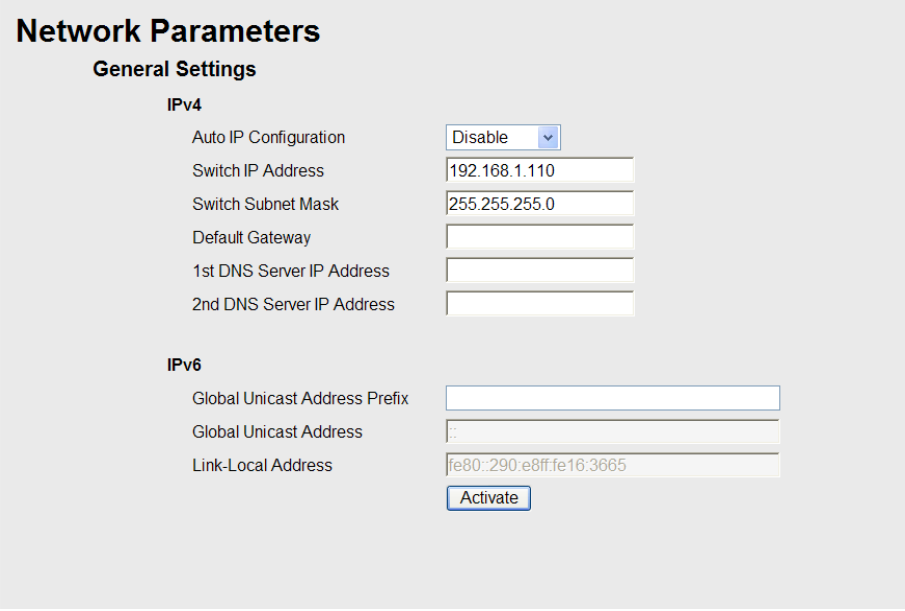
MDI/MDIX

Setting	Description	Factory Default
Auto	Allows the port to auto detect the port type of the opposing Ethernet device and change the port type accordingly.	Auto
MDI	Choose the MDI or MDIX option if the opposing Ethernet device has trouble auto-negotiating port type.	
MDIX		

Network

The **Network** configuration allows users to configure both IPv4 and IPv6 parameters for management access over the network. The IE-SW-PL18M series supports both IPv4 and IPv6, and can be managed through either of these address types.

See a brief explanation of each configuration item below.



IPv4

The IPv4 settings include the switch's IP address and subnet mask, as well as the IP address of the default gateway. In addition, input cells are provided for the IP addresses of a 1st and 2nd DNS server.

IPv6

IPv6 setting includes two distinct address types—Link-Local Unicast address and Global Unicast address. A Link-Local address makes the switch accessible over IPv6 for all devices attached to the same local subnet. To connect to a larger network with multiple segments, the switch must be configured with a Global Unicast address.

Auto IP Configuration

Setting	Description	Factory Default
Disable	Set up the IE-SW-PL18M's IP address manually.	Disable
By DHCP	The IP address will be assigned automatically by the network's DHCP server.	
By BOOTP	The IP address will be assigned automatically by the network's BOOTP server.	

Switch IP Address

Setting	Description	Factory Default
IP Address	Identifies the IE-SW-PL18M on a TCP/IP network.	192.168.1.110

Switch Subnet Mask

Setting	Description	Factory Default
Subnet mask	Identifies the type of network to which the IE-SW-PL18M is connected (e.g., 255.255.0.0 for a Class B network, or 255.255.255.0 for a Class C network).	255.255.255.0

Default Gateway

Setting	Description	Factory Default
Default Gateway	The IP address of the router that connects the LAN to an outside network.	None

DNS IP Address

Setting	Description	Factory Default
1st DNS Server's IP Address	The IP address of the DNS Server used by your network. After entering the DNS Server's IP address, you can input the IE-SW-PL18M's URL (e.g., weidmueller.com) in your browser's address field, instead of entering the IP address.	None
2nd DNS Server's IP Address	The IP address of the DNS Server used by your network. The IE-SW-PL18M will try to locate the 2nd DNS Server if the 1st DNS Server fails to connect.	None

Global Unicast Address Prefix (Prefix Length: 64 bits)

Setting	Description	Factory Default
Global Unicast Address Prefix	The prefix value must be formatted according to RFC 2373 "IPv6 Addressing Architecture," using 8 colon-separated 16-bit hexadecimal values. One double colon may be used in the address to indicate the appropriate number of zeros required to fill the undefined fields.	None

Global Unicast Address

Setting	Description	Factory Default
None	Display IPv6 Global Unicast address. The network portion of Global Unicast address can be configured by specifying the Global Unicast Prefix and using a EUI-64 interface ID in the low order 64 bits. The host portion of Global Unicast address is automatically generated using the modified EUI-64 form of the interface identifier (Switch's MAC address)	::

Link-Local Address

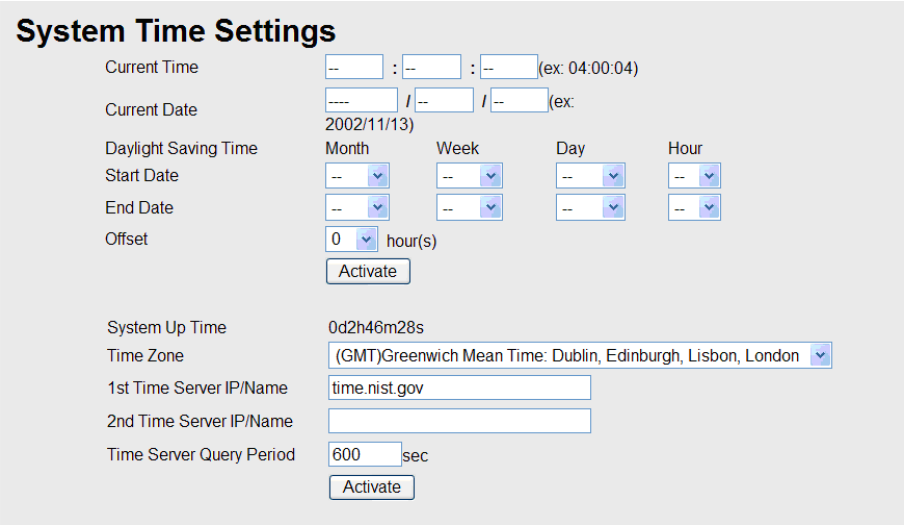
Setting	Description	Factory Default
None	The network portion of Link-Local address is FE80 and the host portion of Link-Local address is automatically generated using the modified EUI-64 form of the interface identifier (Switch's MAC address)	FE80 :: (EUI-64 form of the MAC address)

Neighbor Cache

Setting	Description	Factory Default
None	The information in the neighbor cache that includes the neighboring node IPv6 address, the corresponding Link-Layer address, and current state of the entry.	None

Time

The **Time** configuration page lets users set the time, date, and other settings. An explanation of each setting is given below the figure.



The IE-SW-PL18M has a time calibration function based on information from an NTP server or user specified Time and Date information. Functions such as Auto warning "Email" can add real-time information to the message.

NOTE The IE-SW-PL18M does not have a real time clock. The user must update the Current Time and Current Date to set the initial time for the IE-SW-PL18M after each reboot, especially when the network does not have an Internet connection for an NTP server or there is no NTP server on the LAN.

Current Time

Setting	Description	Factory Default
User adjustable time.	The time parameter allows configuration of the local time in local 24-hour format.	None (hh:mm:ss)

Current Date

Setting	Description	Factory Default
User adjustable date.	The date parameter allows configuration of the local date in yyyy/mm/dd format.	None (yyyy/mm/dd)

Daylight Saving Time

Daylight saving time (also know as **DST** or **summer time**) involves advancing clocks (usually 1 hour) during the summer time to provide an extra hour of daylight in the afternoon.

Start Date

Setting	Description	Factory Default
User adjustable date.	The Start Date parameter allows users to enter the date that daylight saving time begins.	None

End Date

Setting	Description	Factory Default
User adjustable date.	The End Date parameter allows users to enter the date that daylight saving time ends.	None

Offset

Setting	Description	Factory Default
User adjustable hour.	The offset parameter indicates how many hours forward the clock should be advanced.	None

System Up Time

Indicates the IE-SW-PL18M's up time from the last cold start. The unit is seconds.

Time Zone

Setting	Description	Factory Default
User selectable time zone	The time zone setting allows conversion from GMT (Greenwich Mean Time) to local time.	GMT (Greenwich Mean Time)

NOTE Changing the time zone will automatically correct the current time. You should configure the time zone before setting the time.

Time Server IP/Name

Setting	Description	Factory Default
1st Time Server IP/Name	IP or Domain address (e.g., 192.168.1.1 or time.stdtime.gov.tw or time.nist.gov).	None
2nd Time Server IP/Name	The IE-SW-PL18M will try to locate the 2nd NTP Server if the 1st NTP Server fails to connect.	

Time Server Query Period

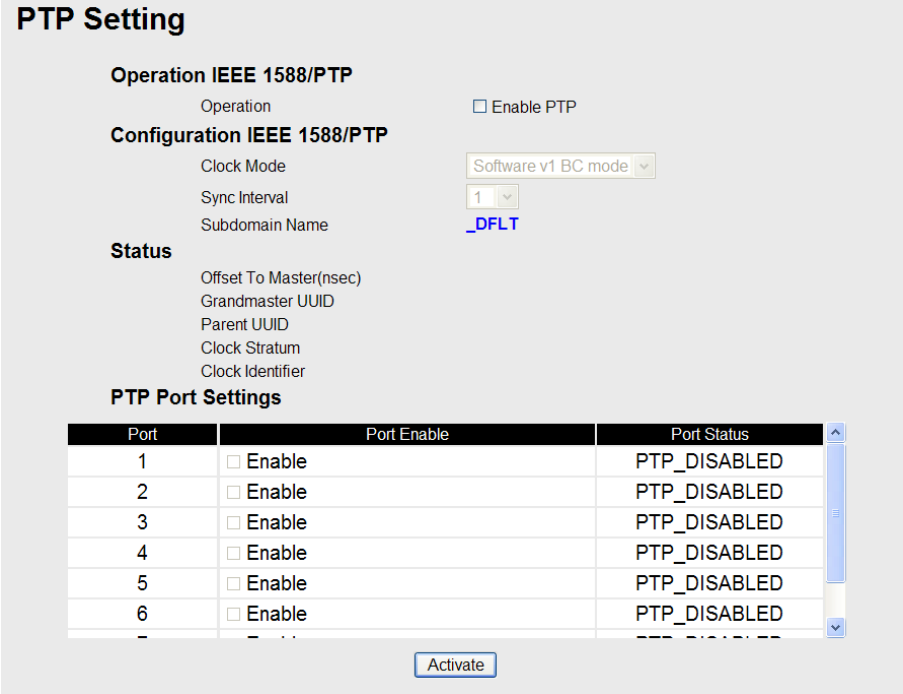
Setting	Description	Factory Default
Query Period	This parameter determines how frequently the time is updated from the NTP server.	600 seconds

IEEE 1588 PTP

The following information is taken from the NIST website at http://ieee1588.nist.gov/intro.htm:

Time measurement can be accomplished using the IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems (IEEE 1588-2008) to synchronize real-time clocks incorporated within each component of the electrical power system for power automation applications.

IEEE 1588, which was published in November 2002, expands the performance capabilities of Ethernet networks to control systems that operate over a communication network. In recent years an increasing number of electrical power systems have been using a more distributed architecture with network technologies that have less stringent timing specifications. IEEE 1588 generates a master-slave relationship between the clocks, and enforces the specific timing requirements in such power systems. All devices ultimately get their time from a clock known as the grandmaster clock. In its basic form, the protocol is intended to be administration free.



PTP Setting

Operation IEEE 1588/PTP

Setting	Description	Factory Default
Operation	Disable or enable IEEE 1588 (PTP) operation	Disable

Configuration IEEE 1588/PTP

Setting	Description	Factory Default
Clock Mode	Support software-based IEEE 1588 (PTP) mode	Disable
Sync Interval	Period for sending synchronization message (in seconds)	Disable
Sub-domain Name	Support _DFLT(Default) domain only	_DFLT

Status

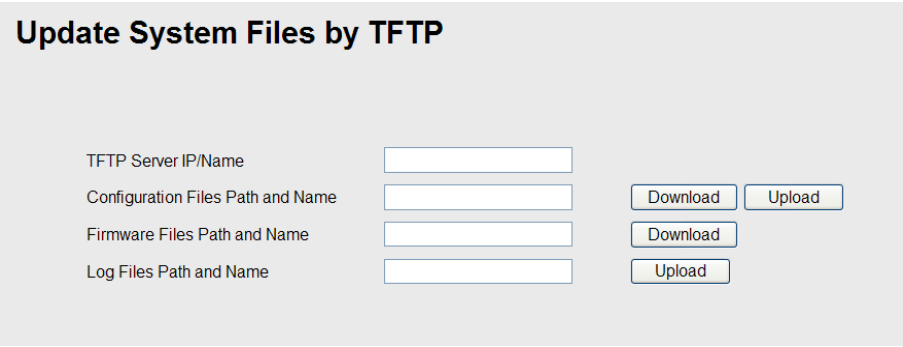
Setting	Description	Factory Default
Offset To Master (nsec)	Deviation between local time and the reference clock (in nanoseconds).	
Grandmaster UUID	When the clock has a port in PTP_SLAVE state, this member's value is the value of the grand master Clock's Uuid field of the last Sync message received from the parent of the slave port.	
Parent UUID	When the clock has a port in PTP_SLAVE state, this member's value is the value of the source-Uuid field of the last Sync message received from the parent of the slave port.	
Clock Stratum	The stratum number describes one measure of the quality of a clock. Each clock is characterized by a stratum number used by the best master clock algorithm as one parameter of clock quality.	4
Clock Identifier	Properties of the clock.	DFLT

PTP Port Settings

Setting	Description	Factory Default
Port Enable	Enable or disable PTP port operation.	None
Port Status	Display PTP port real status.	PTP_DISABLED

System File Update—By Remote TFTP

The IE-SW-PL18M supports saving your configuration file to a remote TFTP server or local host to allow other IE-SW-PL18M switches to use the same configuration at a later time, or saving the Log file for future reference. Loading pre-saved firmware or a configuration file from the TFTP server or local host is also supported for easy upgrading or configuration of the IE-SW-PL18M.



TFTP Server IP/Name

Setting	Description	Factory Default
IP Address of TFTP Server	The IP or name of the remote TFTP server. Must be set up before downloading or uploading files.	None

Configuration Files Path and Name

Setting	Description	Factory Default
Max. 40 Characters	The path and file name of the IE-SW-PL18M's configuration file in the TFTP server.	None

Firmware Files Path and Name

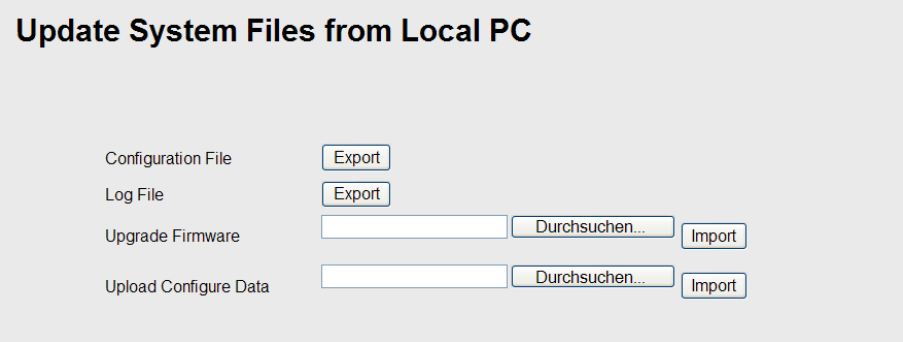
Setting	Description	Factory Default
Max. 40 Characters	The path and file name of the IE-SW-PL18M's firmware file.	None

Log Files Path and Name

Setting	Description	Factory Default
Max. 40 Characters	The path and file name of the IE-SW-PL18M's log file	None

After setting up the desired path and file name, click **Download** to download the prepared file from the remote TFTP server, or click **Upload** to upload the desired file to the remote TFTP server.

System File Update—By Local Import/Export



Configuration File

To export the configuration file of the Ethernet Switch, click **Export** to save it to the local host.

Log File

To export the Log file of the Ethernet Switch, click **Export** and save it to the local host.

NOTE Some operating systems will open the configuration file and log file directly in the web page. In such cases, right click Export to save as a file.

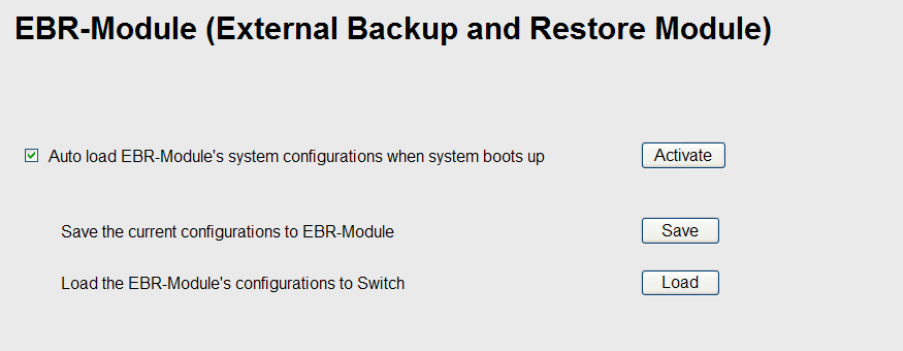
Upgrade Firmware

To import the firmware file of the IE-SW-PL18M, click **Browse** to select the firmware file already saved on your computer. The upgrade procedure will proceed automatically after clicking **Import**.

Upload Configuration Data

To import the configuration file of the Ethernet Switch, click **Browse** to select the configuration file already saved on your computer. The upgrade procedure will proceed automatically after clicking

System File Update—By Backup Media


EBR-Module (External Backup and Restore Module)
Auto load EBR-Module's system configurations when system boots up
Activate
Save the current configurations to EBR-Module
Save
Load the EBR-Module's configurations to Switch
Load

Auto load system configurations when system boots up

Setting	Description	Factory Default
Enable	Enables Auto load system configurations when system boots up	Enable
Disable	Disables Auto load system configurations when system boots up	

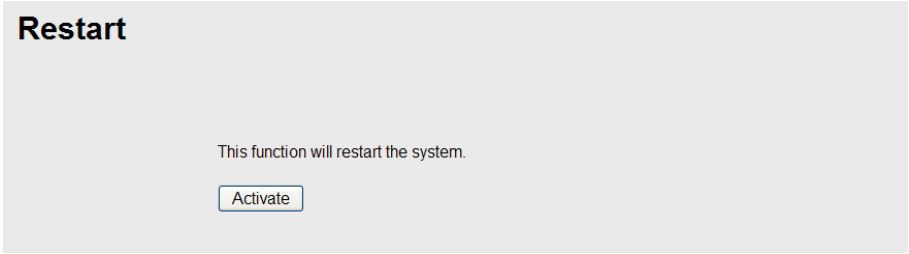
Save the current configurations to the EBR-Module

To export the current configuration file of the IE-SW-PL18M, click on **Save** to save it to the EBR-Module.

Load the EBR-Module's configurations to the Switch

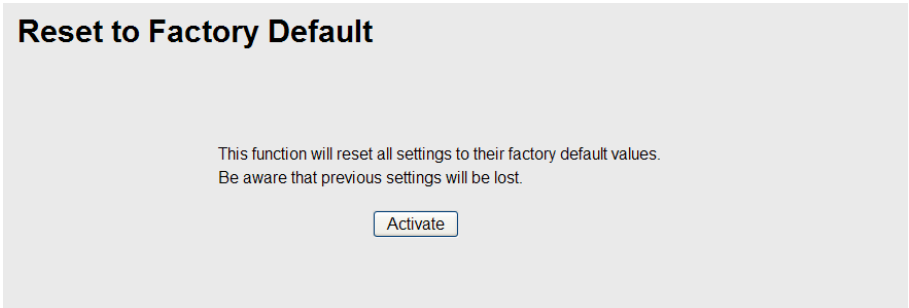
To import the configuration file of the IE-SW-PL18M, click on **Load** to load it to the Switch.

Restart



This function is used to restart the Ethernet Switch.

Factory Default


Reset to Factory Default
This function will reset all settings to their factory default values.
Be aware that previous settings will be lost.
Activate

The Factory Default function is included to give users a quick way of restoring the IE-SW-PL18M's configuration settings to their factory default values. This function is available in the Console utility (serial or Telnet), and Web Browser interface.

NOTE After activating the Factory Default function, you will need to use the default network settings to re-establish a web-browser or Telnet connection with your IE-SW-PL18M.

Using Port Trunking

Link Aggregation allows one or more links to be aggregated together to form a Link Aggregation Group. A MAC client can treat Link Aggregation Groups as if they were a single link.

IE-SW-PL18M's Port Trunking feature allows devices to communicate by aggregating up to 3 trunk groups, with a maximum of 8 ports for each group. If one of the 8 ports fails, the other seven ports will provide back up and share the traffic automatically.

Port trunking can be used to combine up to 8 ports between two IE-SW-PL18M switches. If all ports on both switch units are configured as 100BaseTX and they are operating in full duplex, the potential bandwidth of the connection will be 1600 Mbps.

The Port Trunking Concept

The Port Trunking protocol provides the following benefits:

- Gives you more flexibility in setting up your network connections, since the bandwidth of a link can be doubled, tripled, or quadrupled.
- Provides redundancy—if one link is broken, the remaining trunked ports share the traffic within this trunk group.
- Load sharing—MAC Client traffic may be distributed across multiple links.
- To avoid broadcast storms or loops in your network while configuring a trunk, first disable or disconnect all ports that you want to add to the trunk or remove from the trunk. After you finish configuring the trunk, enable or re-connect the ports.

If all ports on both switch units are configured as 100BaseTX and they are operating in full duplex, the potential bandwidth of the connection will be up to 1.6 Gbps on the IE-SW-PL18M. This means that users can connect one IE-SW-PL18M to another IE-SW-PL18M by Port Trunking to double, triple, or quadruple the bandwidth of the connection.

When configuring Port Trunking, note that:

Each IE-SW-PL18M can set a maximum of 3 Port Trunking groups (Trk1/Trk2, 2 trunk groups for 10/100M ports and Trk3 for Gigabit ports)

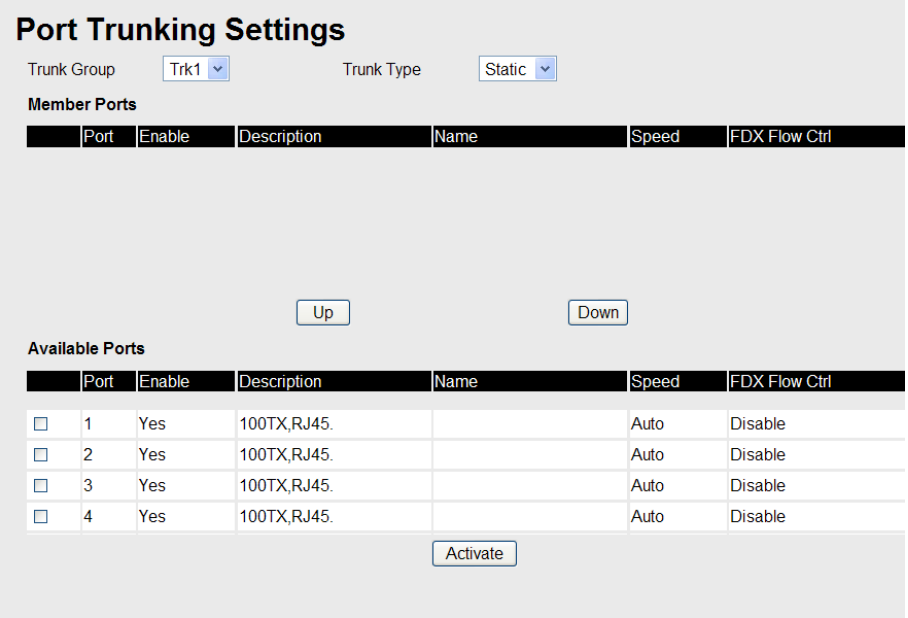
When you activate Port Trunking settings, some advanced functions that you setup with the original ports will either be set to factory default values, or disabled:

- Communication Redundancy will be set to the factory default
- Traffic Prioritization will be set to the factory default
- Port-based VLAN or 802.1Q VLAN will be set to the factory default
- Multicast Filtering will be set to the factory default
- Rate Limiting will be set to the factory default
- Port Access Control will be set to the factory default
- Email and Relay Warning will be set to the factory default
- Set Device IP will be set to the factory default
- Mirror Port will be set to the factory default

You can setup these features again on your Trunking Port.

Configuring Port Trunking

The **Port Trunking Settings** page is used to assign ports to a Trunk Group.



Step 1: Select Trk1, Trk2, or Trk3 from the **Trunk Group** drop-down box.

Step 2: Select Static, or LACP from the **Trunk Type** drop-down box.

Step 3: Under **Member Ports** and **Available Ports**, select the specific ports.

Step 4: Use the **Up** / **Down** buttons to add/remove designated ports to/from a trunk group.

Trunk Group (Maximum of 3 trunk groups on IE-SW-PL18M)

Setting	Description	Factory Default
Trk1, Trk2, Trk3	Display or designate the Trunk Type and Member Ports for Trunk Groups 1, 2, 3.	Trk1

Trunk Type

Setting	Description	Factory Default
Static	Proprietary trunking protocol	Static
LACP	Designated LACP (IEEE 802.3ad, Link Aggregation Control Protocol)	Static

Available Ports/Member Port

Setting	Description	Factory Default
Member/Available Ports	Use Up/Down buttons to add/remove specific ports from available ports to/from trunk group.	N/A
Check box	Check to designate which ports to add or remove.	Unchecked
Port	Port number.	N/A
Port description	Displays the media type for each module's port.	N/A
Name	Max. 63 Characters.	N/A
Speed	Indicates the transmission speed (100M-Full, 100M-Half, 10M-Full, or 10M-Half)	N/A
FDX Flow Control	Indicates if the FDX flow control of this port is "Enabled" or "Disabled."	N/A
Up	Add designated ports into trunk group from available ports.	N/A
Down	Remove designated ports from trunk group to available port.	N/A

Trunk Table

Setting	Description
Trunk Group	Displays the Trunk Type and Trunk Group.
Member Port	Display which member ports belong to the trunk group.
Status	Success means port trunking is working properly. Fail means port trunking is not working properly.

Configuring SNMP

The IE-SW-PL18M supports SNMP V1/V2c/V3. SNMP V1 and SNMP V2c use a community string match for authentication, which means that SNMP servers access all objects with read-only or read/write permissions using the community string *public/private* (default value). SNMP V3, which requires you to select an authentication level of MD5 or SHA, is the most secure protocol. You can also enable data encryption to enhance data security.

SNMP security modes and security levels supported by the IE-SW-PL18M are shown in the following table. Select the security mode and level that will be used to communicate between the SNMP agent and manager.

Protocol Version	UI Setting	Authentication Type	Data Encryption	Method
SNMP V1, V2c	V1, V2c Read Community	Community string	No	Use a community string match for authentication
	V1, V2c Write/Read Community	Community string	No	Use a community string match for authentication
SNMP V3	No-Auth	No	No	Use account with admin or user to access objects
	MD5 or SHA	Authentication based on MD5 or SHA	No	Provides authentication based on HMAC-MD5, or HMAC-SHA algorithms. 8-character passwords are the minimum requirement for authentication.
	MD5 or SHA	Authentication based on MD5 or SHA	Data encryption key	Provides authentication based on HMAC-MD5 or HMAC-SHA algorithms, and data encryption key. 8-character passwords and a data encryption key are the minimum requirements for authentication and encryption.

These parameters are configured on the SNMP page. A more detailed explanation of each parameter follows.

SNMP Read/Write Settings

SNMP Versions

Setting	Description	Factory Default
V1, V2c, V3, or V1, V2c, or V3 only	Select the SNMP protocol version used to manage the switch.	V1, V2c

V1, V2c Read Community

Setting	Description	Factory Default
V1, V2c Read Community	Use a community string match with a maximum of 30 characters for authentication. The SNMP agent accesses all objects with read-only permissions using the community string public.	public

V1, V2c Write/Read Community

Setting	Description	Factory Default
V1, V2c Read/Write Community	Uses a community string match with a maximum of 30 characters for authentication. The SNMP servers access all objects with read/write permissions using the community string private.	private

For SNMP V3, there are two levels of privileges for different accounts to access the IE-SW-PL18M. **Admin** privilege allows access, and authorization to read and write the MIB file. **User** privilege only allows reading the MIB file, but does not have authorization to write.

Admin Auth. Type (for SNMP V1, V2c, V3, and V3 only)

Setting	Description	Factory Default
No-Auth	Use admin. account to access objects. No authentication	No
MD5-Auth	Provide authentication based on the HMAC-MD5 algorithms. 8-character passwords are the minimum requirement for authentication.	No
SHA-Auth	Provide authentication based on the HMAC-SHA algorithms. 8-character passwords are the minimum requirement for authentication.	No

Admin Data Encryption Key (for SNMP V1, V2c, V3, and V3 only)

Setting	Description	Factory Default
Enable	8-character data encryption key is the minimum requirement for data encryption (maximum of 30 characters)	No
Disable	No data encryption	No

User Auth. Type (for SNMP V1, V2c, V3 and V3 only)

Setting	Description	Factory Default
No-Auth	Use admin account or user account to access objects. No authentication.	No
MD5-Auth	Provides authentication based on the HMAC-MD5 algorithms. 8-character passwords are the minimum requirement for authentication.	No
SHA-Auth	Provides authentication based on the HMAC-SHA algorithms. 8-character passwords are the minimum requirement for authentication.	No

User Data Encryption Key (for SNMP V1, V2c, V3 and V3 only)

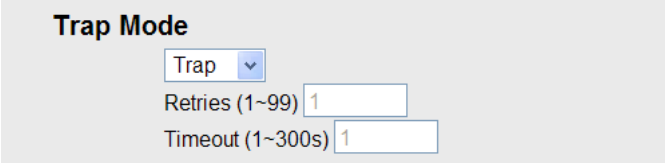
Setting	Description	Factory Default
Enable	8-character data encryption key is the minimum requirement for data encryption (maximum of 30 characters)	No
Disable	No data encryption	No

Trap Settings

SNMP traps allow an SNMP agent to notify a Network Management System (NMS) of a significant event. The IE-SW-PL18M supports two SNMP modes, Trap mode and Inform mode.

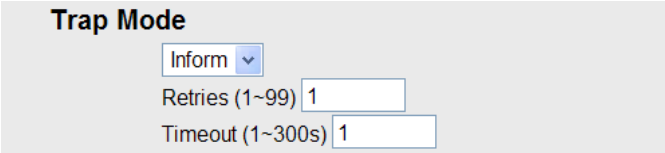
SNMP Trap Mode

In Trap mode, the SNMP agent sends a SNMPv1 trap PDU to the NMS. No acknowledgment is sent back from the NMS so the agent has no way of knowing if the trap reached the NMS.



SNMP Inform Mode

SNMPv2 provides an inform mechanism. When an inform message is sent from the SNMP agent to the NMS, the receiver sends a response to the sender acknowledging receipt of the event. This behavior is similar to that of the get and set requests. If the SNMP agent doesn't receive a response from the NMS for a period of time, the agent will resend the trap to the NMS agent. The maximum timeout time is 300 secs (default is 1 sec), and the maximum number of retries is 99 times (default is 1 time). When the SNMP agent receives acknowledgement from the NMS, it will stop resending the inform messages.



1st Trap Server IP/Name

Setting	Description	Factory Default
IP or Name	Enter the IP address or name of the 1st Trap Server used by your network.	None

1st Trap Community

Setting	Description	Factory Default
character string	Use a community string match for authentication (maximum of 30 characters).	public

2nd Trap Server IP/Name

Setting	Description	Factory Default
IP or Name	Enter the IP address or name of the 2nd Trap Server used by your network.	None

2nd Trap Community

Setting	Description	Factory Default
character string	Use a community string match for authentication (maximum of 30 characters).	public

Inform Mode Select

Setting	Description	Factory Default
Retries	Enter Inform Retry number	1
Timeout	Enter Inform Timeout window	1

Private MIB information

Switch Object ID

Setting	Description	Factory Default
8691.7.5 for IE-SW-PL18M	IE-SW-PL18M's enterprise value	Fixed

NOTE: The Switch Object ID cannot be changed.

Using Communication Redundancy

Setting up Communication Redundancy on your network helps protect critical links against failure, protects against network loops, and keeps network downtime at a minimum.

The Communication Redundancy function allows the user to set up *redundant loops* in the network to provide a backup data transmission route in the event that a cable is inadvertently disconnected or damaged. This feature is particularly important for industrial applications, since it could take several minutes to locate the disconnected or severed cable. For example, if the IE-SW-PL18M is used as a key communications component of a production line, several minutes of downtime could result in a big loss in production and revenue. The IE-SW-PL18M switches have implemented three different protocols to support this communication redundancy function:

- **Rapid Spanning Tree/ Spanning Tree Protocol (IEEE 802.1W/1D)**
- **Turbo Ring**, / **Turbo Ring V2**
- **Turbo Chain**

When configuring a redundant ring, all switches on the same ring must be configured to use the same redundancy protocol. **You cannot mix the "Turbo Ring," "Turbo Ring V2," and STP/RSTP protocols on the same ring.** The following table lists the key differences between each feature. Use this information to evaluate the benefits of each, and then determine which features are most suitable for your network.

	Turbo Ring V2	Turbo Ring	Turbo Chain	STP	RSTP
Topology	Ring	Ring	Chain	Ring, Mesh	Ring, Mesh
Recovery Time	< 20 ms	< 300 ms	< 20 ms	Up to 30 sec.	Up to 5 sec

NOTE All Weidmüller managed switches support the following Turbo Ring / Turbo Chain protocols:

1. "Turbo Ring" refers to the original version of redundant ring protocol, which has a recovery time of under 300 ms.
2. "Turbo Ring V2" refers to the new generation Turbo Ring, which has a recovery time of under 20 ms.
3. "Turbo Chain" is a new protocol with unlimited flexibly to allow you to construct any type of redundant network topology. The recovery time is under 20 ms.

In this manual, we use the terminology "Turbo Ring" ring and "Turbo Ring V2" ring to differentiate between rings configured for one or the other of these protocols.

Gigabit Ethernet Redundant Ring Capability (< 50 ms)

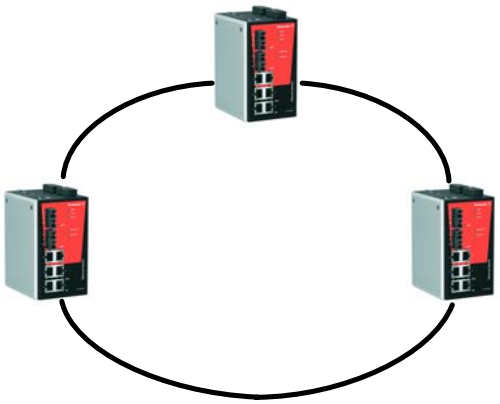
Ethernet has become the default data communications medium for industrial automation applications. In fact, Ethernet is often used to integrate video, voice, and high-rate industrial application data transfers into one network. Weidmüller IE-SW-PL18M, which comes equipped with a redundant Gigabit Ethernet protocol called Gigabit Turbo Ring, gives system maintainers a convenient means of setting up a versatile yet stable Gigabit Ethernet network. With Gigabit Turbo Ring, if any segment of the network gets disconnected, your automation system will be back to normal in less than 300 ms (Turbo Ring) or 50 ms (Turbo Ring V2).

NOTE Port trunking and Turbo Ring can be enabled simultaneously to form a backbone. Doing so will increase the bandwidth of the backbone, and also provide redundancy. For example, suppose that two physical ports, 1 and 2, are trunked to form trunk group Trk1, and then Trk1 is set as one Turbo Ring path, if port 1 gets disconnected, the remaining trunked port, port 2, will share the traffic. If port 1 and port 2 are both disconnected, Turbo Ring will create the back up path within 300 ms.

The Turbo Ring Concept

With Turbo Ring protocol you can optimize communication redundancy and achieve a faster recovery time on the network.

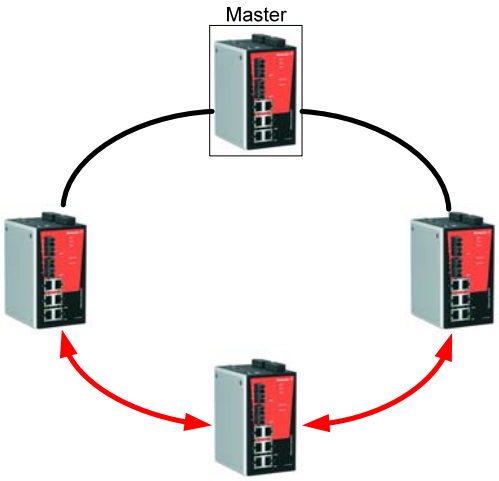
The Turbo Ring and Turbo Ring V2 protocols identify one switch as the ***master*** of the network, and then automatically block packets from traveling through any of the network's redundant loops. In the event that one branch of the ring gets disconnected from the rest of the network, the protocol automatically readjusts the ring so that the part of the network that was disconnected can reestablish contact with the rest of the network.

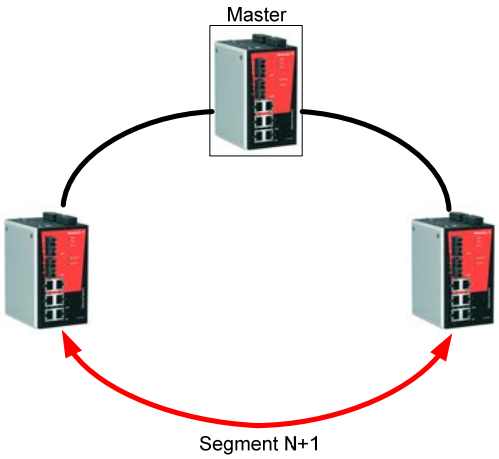
Initial setup of a "Turbo Ring" or "Turbo Ring V2" ring	
	1. For each switch in the ring, select any two ports as the redundant ports. 2. Connect redundant ports on neighboring switches to form the redundant ring.

The user does not need to configure any of the switches as the master to use Turbo Ring or Turbo Ring V2. If none of the switches in the ring is configured as the master, then the protocol will automatically assign master status to one of the switches. In fact, the master is only used to identify which segment in the redundant ring acts as the backup path. In the following subsections, we explain how the redundant path is selected for rings configured for Turbo Ring, and Turbo Ring V2.

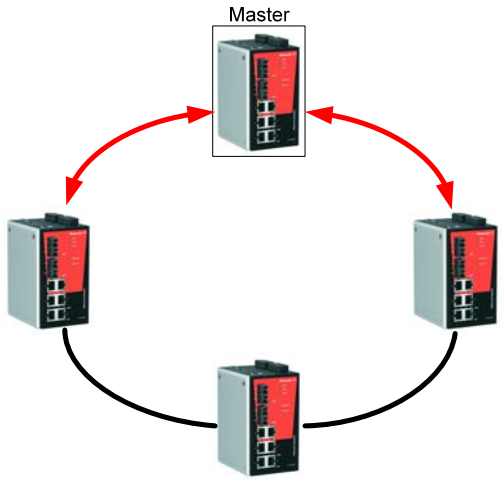
Determining the Redundant Path of a "Turbo Ring" Ring

In this case, the redundant segment (i.e., the segment that will be blocked during normal operation) is determined by the number of IE-SW-PL18M units that make up the ring, and where the ring master is located.

"Turbo Ring" rings with an even number of IE-SW-PL18M units	
	If there are 2N IE-SW-PL18M units (an even number) in the "Turbo Ring" ring, then the backup segment is one of the two segments connected to the (N+1)st IE-SW-PL18M (i.e., the IE-SW-PL18M unit directly opposite the master).

"Turbo Ring" rings with an odd number of IE-SW-PL18M units	
	If there are 2N+1 IE-SW-PL18M units (an odd number) in the "Turbo Ring" ring, with IE-SW-PL18M units and segments labeled counterclockwise, then segment N+1 will serve as the backup path. For the example shown here, N=1, so that N+1=2.

Determining the Redundant Path of a "Turbo Ring V2" Ring



For a "Turbo Ring V2" ring, the backup segment is the segment connected to the 2nd redundant port on the master.

See Configuring "Turbo Ring V2" in the Configuring "Turbo Ring" and "Turbo Ring V2" section below.

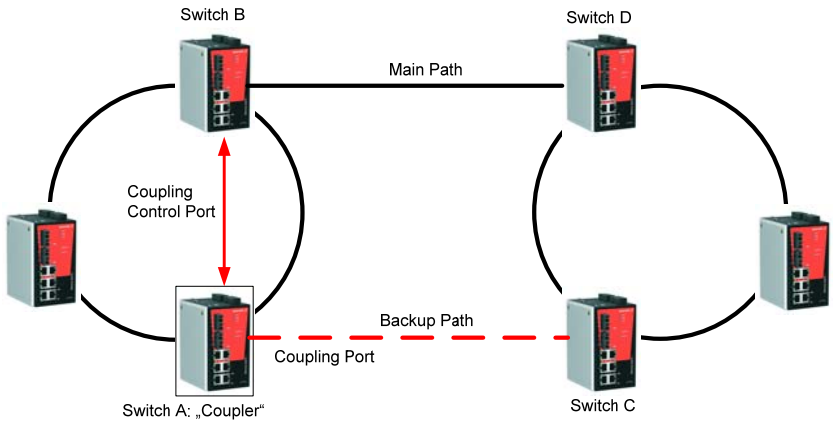
Ring Coupling Configuration

For some systems, it may not be convenient to connect all devices in the system to create one huge redundant ring, since some devices could be located in a remote area. For these systems, "Ring Coupling" can be used to separate the devices into different smaller redundant rings, but in such a way that they can still communicate with each other.

ATTENTION

In a VLAN environment, the user must set "Redundant Port," "Coupling Port," and "Coupling Control Port" to join all VLANs, since these ports act as the "backbone" to transmit all packets of different VLANs to different IE-SW-PL18M units.

Ring Coupling for a "Turbo Ring" Ring

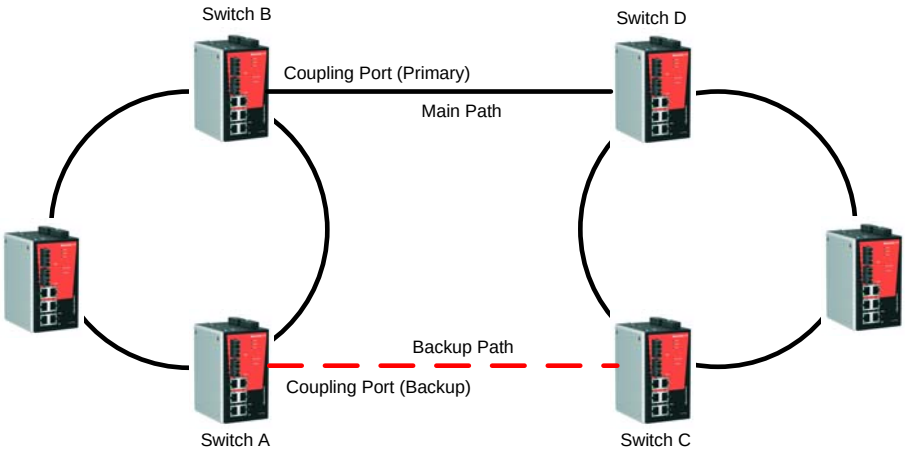


To configure the Ring Coupling function for a "Turbo Ring" ring, select two IE-SW-PL18M units (e.g., Switch A and B in the above figure) in the ring, and another two IE-SW-PL18M units in the adjacent ring (e.g., Switch C and D).

Decide which two ports in each switch are appropriate to be used as coupling ports, and then link them together. Next, assign one switch (e.g., Switch A) to be the "coupler," and connect the coupler's coupling control port with Switch B (for this example).

The coupler switch (i.e., Switch A) will monitor switch B through the coupling control port to determine whether or not the coupling port's backup path should be recovered.

Ring Coupling for a "Turbo Ring V2" Ring



Note that the ring coupling settings for a "Turbo Ring V2" ring are different from a "Turbo Ring" ring. For Turbo Ring V2, Ring Coupling is enabled by configuring the "Coupling Port (Primary) on Switch B and the „Coupling Port (Backup) on Switch A only. You do not need to set up a coupling control port, so that a "Turbo Ring V2" ring does not use a coupling control line.

The "Coupling Port (Backup)" on Switch A is used for the backup path, and connects directly to an extra network port on Switch C. The "Coupling Port (Primary)" on Switch B monitors the status of the main path, and connects directly to an extra network port on Switch D. With ring coupling established, Switch A can activate the backup path as soon as it detects a problem with the main path.

ATTENTION

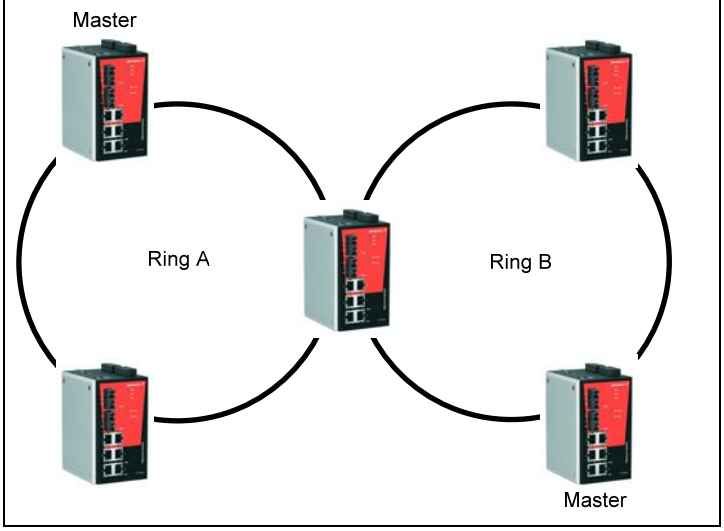
Ring Coupling only needs to be enabled on one of the switches serving as the Ring Coupler. The Coupler must designate different ports as the two Turbo Ring ports and the coupling port.

NOTE You do not need to use the same Ethernet Switch for both Ring Coupling and Ring Master.

Dual-Ring Configuration (applies only to "Turbo Ring V2")

The "dual-ring" option provides another ring coupling configuration, in which two adjacent rings share one switch. This type of configuration is ideal for applications that have inherent cabling difficulties.

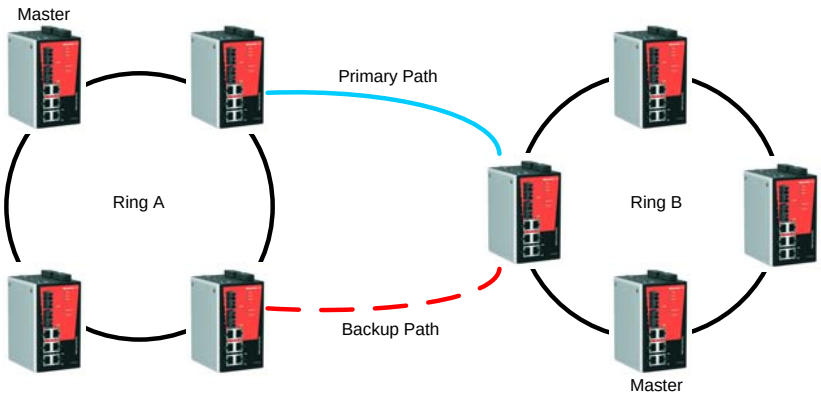
Dual-Ring for a "Turbo Ring V2" Ring



Dual-Homing Configuration (applies only to "Turbo Ring V2")

The "dual-homing" option uses a single Ethernet switch to connect two networks. The primary path is the operating connection, and the backup path is a back-up connection that is activated in the event that the primary path connection fails.

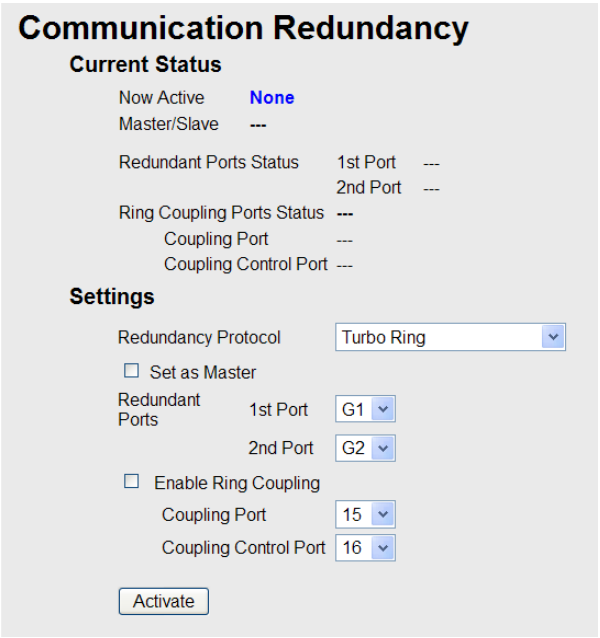
Dual-Homing for a "Turbo Ring V2" Ring



Configuring "Turbo Ring" and "Turbo Ring V2"

Use the **Communication Redundancy** page to configure select "Turbo Ring" or "Turbo Chain" or "Turbo Ring V2." Note that configuration pages for these two protocols are different.

Configuring "Turbo Ring"



Explanation of "Current Status" Items

Now Active

Shows which communication protocol is in use: **Turbo Ring**, **Turbo Ring V2**, **RSTP**, or **None**.

Master/Slave

Indicates whether or not this IE-SW-PL18M is the Master of the Turbo Ring. (This field appears only when selected to operate in Turbo Ring or Turbo Ring V2 mode.)

NOTE The user does not need to set the master to use Turbo Ring. If no master is set, the Turbo Ring protocol will assign master status to one of the IE-SW-PL18M units in the ring. The master is only used to determine which segment serves as the backup path.

Redundant Ports Status (1st Port, 2nd Port)

Ring Coupling Ports Status (Coupling Port, Coupling Control Port)

The "Ports Status" indicators show ***Forwarding*** for normal transmission, ***Blocking*** if this port is connected to a backup path and the path is blocked, and ***Link down*** if there is no connection.

Explanation of "Settings" Items

Redundancy Protocol

Setting	Description	Factory Default
Turbo Ring	Select this item to change to the Turbo Ring configuration page.	None
Turbo Ring V2	Select this item to change to the Turbo Ring V2 configuration page.	
Turbo Chain	Select this item to change to the Turbo Chain configuration page.	
RSTP (IEEE 802.1W/1D)	Select this item to change to the RSTP configuration page.	
None	Ring redundancy is not active	

Set as Master

Setting	Description	Factory Default
Enabled	Select this IE-SW-PL18M as Master	Not checked
Disabled	Do not select this IE-SW-PL18M as Master	

Redundant Ports

Setting	Description	Factory Default
1st Port	Select any port of the IE-SW-PL18M to be one of the redundant ports.	port G1
2nd Port	Select any port of the IE-SW-PL18M to be one of the redundant ports.	port G2

Enable Ring Coupling

Setting	Description	Factory Default
Enable	Select this IE-SW-PL18M as Coupler	Not checked
Disable	Do not select this IE-SW-PL18M as Coupler	

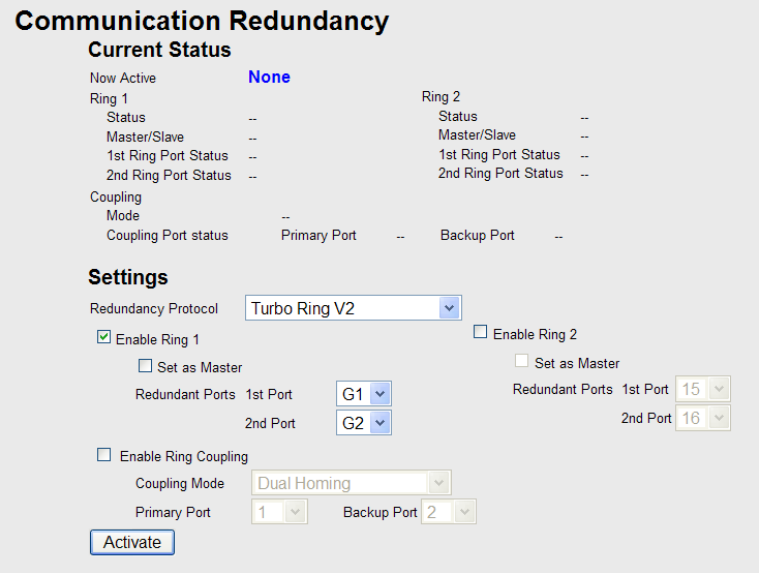
Coupling Port

Setting	Description	Factory Default
Coupling Port	Select any port of the IE-SW-PL18M to be the coupling port	port 15

Coupling Control Port

Setting	Description	Factory Default
Coupling Control Port	Select any port of the IE-SW-PL18M to be the coupling control port	port 16

Configuring "Turbo Ring V2"



NOTE When using the Dual-Ring architecture, users must configure settings for both Ring 1 and Ring 2. In this case, the status of both rings will appear under "Current Status."

Explanation of "Current Status" Items

Now Active

Shows which communication protocol is in use: **Turbo Ring**, **Turbo Chain, Turbo Ring V2**, **RSTP**, or **None**.

Ring 1/2—Status

Shows **Healthy** if the ring is operating normally, and shows **Break** if the ring's backup link is active.

Ring 1/2—Master/Slave

Indicates whether or not this IE-SW-PL18M is the Master of the Turbo Ring. (This field appears only when selected to operate in Turbo Ring or Turbo Ring V2 mode.)

NOTE The user does not need to set the master to use Turbo Ring. If no master is set, the Turbo Ring protocol will assign master status to one of the IE-SW-PL18M units in the ring. The master is only used to determine which segment serves as the backup path.

Ring 1/2—1st Ring Port Status

Ring 1/2—2nd Ring Port Status

The "Ports Status" indicators show ***Forwarding*** for normal transmission, ***Blocking*** if this port is connected to a backup path and the path is blocked, and ***Link down*** if there is no connection.

Coupling—Mode

Indicates either **None**, **Dual Homing**, or **Ring Coupling**.

Coupling—Coupling Port status

Indicates either **Primary**, or **Backup**.

Explanation of "Settings" Items

Redundancy Protocol

Setting	Description	Factory Default
Turbo Ring	Select this item to change to the Turbo Ring configuration page.	None
Turbo Ring V2	Select this item to change to the Turbo Ring V2 configuration page.	
Turbo Chain	Select this item to change to the Turbo Chain configuration page	
RSTP (IEEE 802.1W/1D)	Select this item to change to the RSTP configuration page.	
None	Ring redundancy is not active	

Enable Ring 1

Setting	Description	Factory Default
Enabled	Enable the Ring 1 settings	Not checked
Disabled	Disable the Ring 1 settings	

Enable Ring 2*

Setting	Description	Factory Default
Enabled	Enable the Ring 2 settings	Not checked
Disabled	Disable the Ring 2 settings	

*You should enable both Ring 1 and Ring 2 when using the Dual-Ring architecture.

Set as Master

Setting	Description	Factory Default
Enabled	Select this IE-SW-PL18M as Master	Not checked
Disabled	Do not select this IE-SW-PL18M as Master	

Redundant Ports

Setting	Description	Factory Default
1st Port	Select any port of the IE-SW-PL18M to be one of the redundant ports.	Ring 1: port G1 Ring 2: port 15
2nd Port	Select any port of the IE-SW-PL18M to be one of the redundant ports.	Ring 1: port G2 Ring 2: port 16

Enable Ring Coupling

Setting	Description	Factory Default
Enable	Select this IE-SW-PL18M as Coupler	Not checked
Disable	Do not select this IE-SW-PL18M as Coupler	

Coupling Mode

Setting	Description	Factory Default
Dual Homing	Select this item to change to the Dual Homing configuration page	Primary Port: port 15 Backup Port: port 16
Ring Coupling (backup)	Select this item to change to the Ring Coupling (backup) configuration page	Coupling Port: port 15
Ring Coupling (primary)	Select this item to change to the Ring Coupling (primary) configuration page	Coupling Port: port 15

Primary/Backup Port

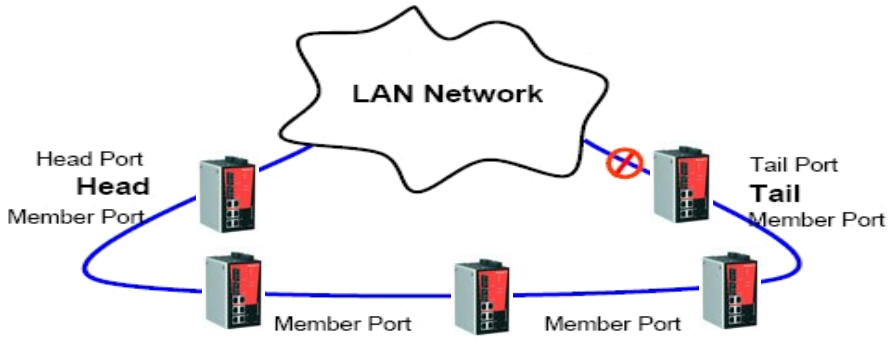
Setting	Description	Factory Default
Primary Port	Select any port of the IE-SW-PL18M to be the primary port.	port 15
Backup Port	Select any port of the IE-SW-PL18M to be the backup port.	port 16

The Turbo Chain Concept

Turbo Chain is an advanced software-technology that gives network administrators the flexibility of constructing any type of redundant network topology. When using the "chain" concept, you first connect the Ethernet switches in a chain and then simply link the two ends of the chain to an Ethernet network, as illustrated in the following figure.

Turbo Chain can be used on industrial networks that have a complex topology. If the industrial network uses a multi-ring architecture, Turbo Chain can be used to create flexible and scalable topologies with a fast media-recovery time.

Set Up Turbo Chain

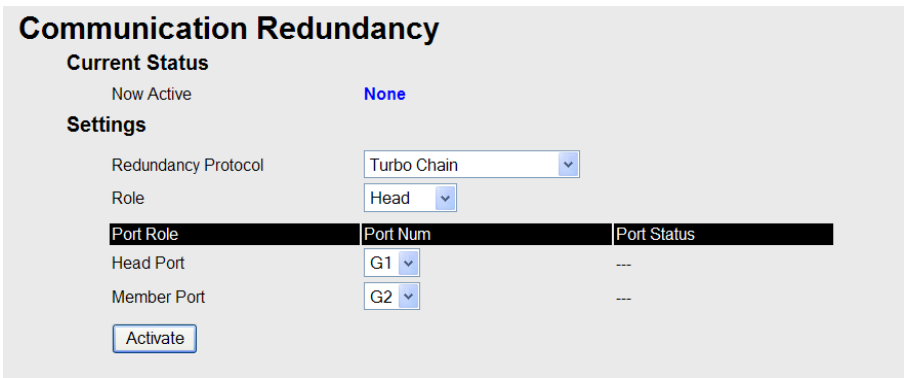


1. Select the Head switch, Tail switch, and Member switches.
2. Configure one port as the Head port and one port as the Member port in the Head switch, configure one port as the Tail port and one port as the Member port in the Tail switch, and configure two ports as Member ports in each of the Member switches.
3. Connect the Head switch, Tail switch, and Member switches as shown in the diagram.

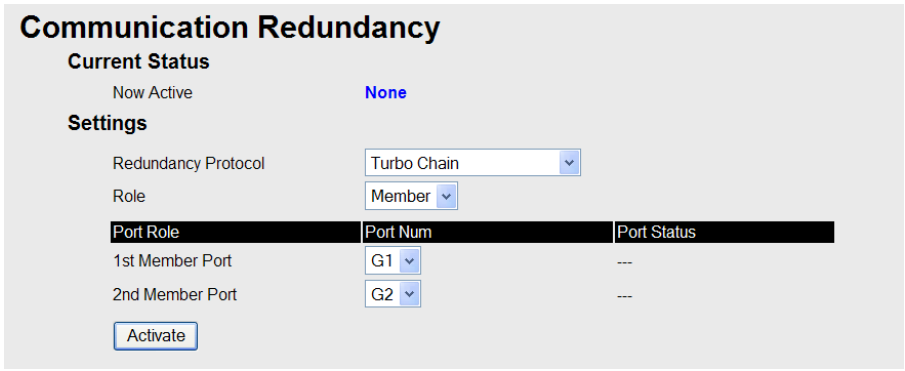
The path connecting to the Head port is the main path, and the path connecting to the Tail port is the back up path of the Turbo Chain. Under normal conditions, packets are transmitted through the Head Port to the LAN Network. If any Turbo Chain path is disconnected, the Tail Port will be activated to continue packet transmission.

Configuring "Turbo Chain"

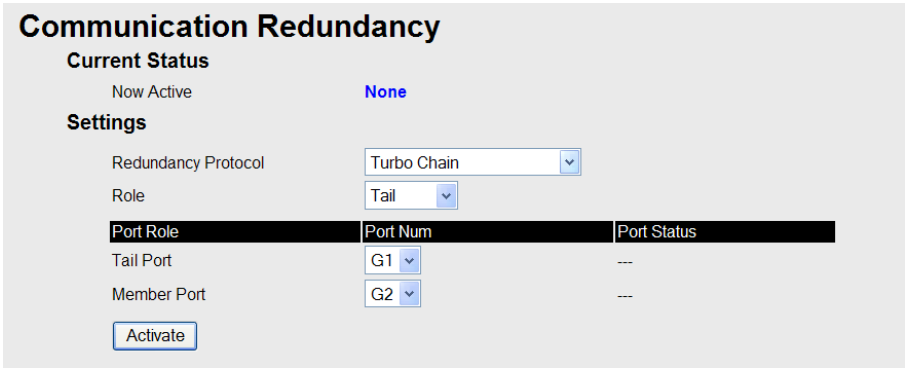
Head Switch Configuration



Member Switch Configuration



Tail Switch Configuration



Explanation of "Current Status" Items

Now Active

Shows which communication protocol is in use: **Turbo Ring**, **Turbo Ring V2**, **RSTP**, **Turbo Chain** or **None**.

The "Ports Status" indicators show ***Forwarding*** for normal transmission, ***Blocked*** if this port is connected to the Tail port as a backup path and the path is blocked, and ***Link down*** if there is no connection.

Explanation of "Settings" Items

Redundancy Protocol

Setting	Description	Factory Default
Turbo Ring	Select this item to change to the Turbo Ring configuration page.	None
Turbo Ring V2	Select this item to change to the Turbo Ring V2 configuration page.	
Turbo Chain	Select this item to change to the Turbo Chain configuration page	
RSTP (IEEE 802.1W/1D)	Select this item to change to the RSTP configuration page.	
None	Ring redundancy is not active	

Role

Setting	Description	Factory Default
Head	Select this Ethernet Switch as Head Switch	Member
Member	Select this Ethernet Switch as Member Switch	
Tail	Select this Ethernet Switch as Tail Switch	

Head Role

Setting	Description	Factory Default
Head Port	Select any port of the Ethernet Switch to be the head port.	port G1
Member Port	Select any port of the Ethernet Switch to be the member port.	Port G2

Member Role

Setting	Description	Factory Default
1st Member port	Select any port of the Ethernet Switch to be the 1st member port	Port G1
2nd Member port	Select any port of the Ethernet Switch to be the 2nd member port	Port G2

Tail Role

Setting	Description	Factory Default
Tail Port	Select any port of the Ethernet Switch to be the tail port.	port G1
Member Port	Select any port of the Ethernet Switch to be the member port.	port G2

The STP/RSTP Concept

Spanning Tree Protocol (STP) was designed to help reduce link failures in a network, and provide protection from loops. Networks that have a complicated architecture are prone to broadcast storms caused by unintended loops in the network. The STP feature is disabled by default. To be completely effective, you must enable RSTP/STP on every IE-SW-PL18M connected to your network.

Rapid Spanning Tree Protocol (RSTP) implements the Spanning Tree Algorithm and Protocol defined by IEEE Std 802.1w-2001. RSTP provides the following benefits:

- The topology of a bridged network will be determined much more quickly compared to STP.
- I RSTP is backward compatible with STP, making it relatively easy to deploy. For example:
  - Defaults to sending 802.1D style BPDUs if packets with this format are received.
  - STP (802.1D) and RSTP (802.1w) can operate on different ports of the same IE-SW-PL18M. This feature is particularly helpful when the IE-SW-PL18M's ports connect to older equipment, such as legacy switches.

You get essentially the same functionality with RSTP and STP. To see how the two systems differ, see the *Differences between RSTP and STP* section in this chapter.

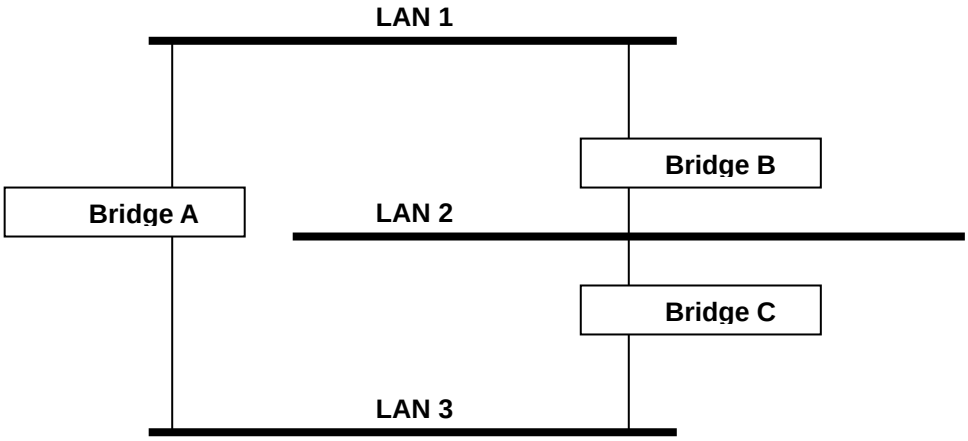
NOTE The STP protocol is part of the IEEE Std 802.1D, 1998 Edition bridge specification. The following explanation uses bridge instead of switch.

What is STP?

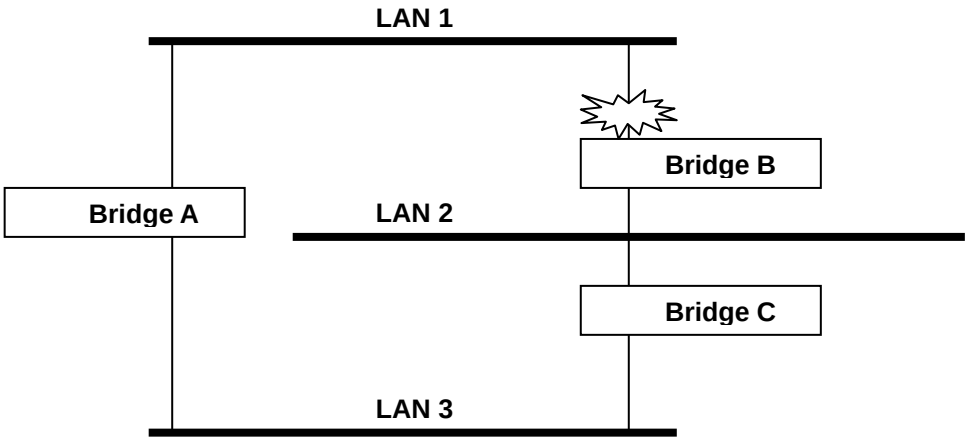
STP (802.1D) is a bridge-based system that is used to implement parallel paths for network traffic. STP uses a loop-detection process to:

- Locate and then disable less efficient paths (i.e., paths that have a lower bandwidth).
- Enable one of the less efficient paths if the most efficient path fails.

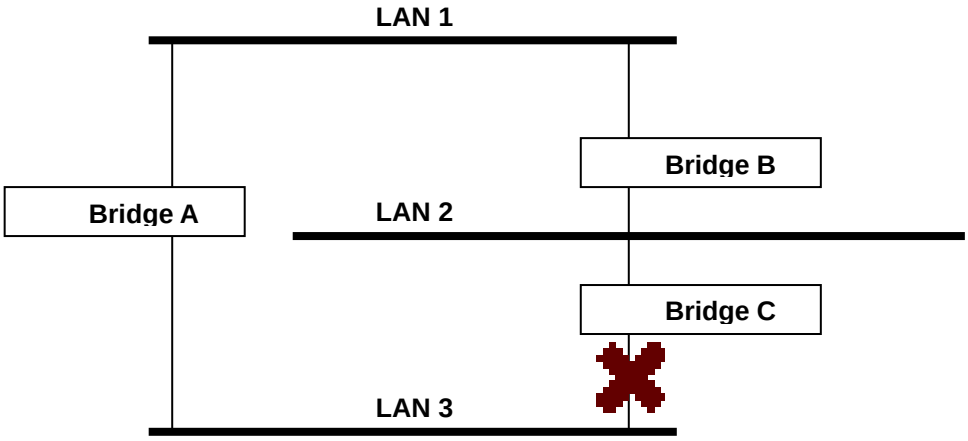
The figure below shows a network made up of three LANs separated by three bridges. Each segment uses at most two paths to communicate with the other segments. Since this configuration can give rise to loops, the network will overload if STP is NOT enabled.



If STP is enabled, it will detect duplicate paths and prevent, or *block*, one of them from forwarding traffic. In the following example, STP determined that traffic from LAN segment 2 to LAN segment 1 should flow through Bridges C and A because this path has a greater bandwidth and is therefore more efficient.



What happens if a link failure is detected? As shown in next figure, the STP process reconfigures the network so that traffic from LAN segment 2 flows through Bridge B.



STP will determine which path between each bridged segment is most efficient, and then assigns a specific reference point on the network. When the most efficient path has been identified, the other paths are blocked. In the previous 3 figures, STP first determined that the path through Bridge C was the most efficient, and as a result, blocked the path through Bridge B. After the failure of Bridge C, STP re-evaluated the situation and opened the path through Bridge B.

How STP Works

When enabled, STP determines the most appropriate path for traffic through a network. The way it does this is outlined in the sections below.

STP Requirements

Before STP can configure the network, the system must satisfy the following requirements:

- Communication between all the bridges. This communication is carried out using Bridge Protocol Data Units (BPDUs), which are transmitted in packets with a known multicast address.
- Each bridge must have a Bridge Identifier that specifies which bridge acts as the central reference point, or Root Bridge, for the STP system—bridges with a lower Bridge Identifier are more likely to be designated as the Root Bridge. The Bridge Identifier is calculated using the MAC address of the bridge and a priority defined for the bridge. The default priority of the IE-SW-PL18M switch is 32768.
- Each port has a cost that specifies the efficiency of each link. The efficiency cost is usually determined by the bandwidth of the link, with less efficient links assigned a higher cost. The following table shows the default port costs for a switch:

Port Speed	Path Cost 802.1D, 1998 Edition	Path Cost 802.1w-2001
10 Mbps	100	2,000,000
100 Mbps	19	200,000
1000 Mbps	4	20,000

STP Calculation

The first step of the STP process is to perform calculations. During this stage, each bridge on the network transmits BPDUs. The following items will be calculated:

- Which bridge should be the Root Bridge. The Root Bridge is the central reference point from which the network is configured.
- The Root Path Costs for each bridge. This is the cost of the paths from each bridge to the Root Bridge.
- The identity of each bridge's Root Port. The Root Port is the port on the bridge that connects to the Root Bridge via the most efficient path. In other words, the port connected to the Root Bridge via the path with the lowest Root Path Cost. The Root Bridge, however, does not have a Root Port.
- The identity of the Designated Bridge for each LAN segment. The Designated Bridge is the bridge with the lowest Root Path Cost from that segment. If several bridges have the same Root Path Cost, the one with the lowest Bridge Identifier becomes the Designated Bridge. Traffic transmitted in the direction of the Root Bridge will flow through the Designated Bridge. The port on this bridge that connects to the segment is called the Designated Bridge Port.

STP Configuration

After all the bridges on the network agree on the identity of the Root Bridge, and all other relevant parameters have been established, each bridge is configured to forward traffic only between its Root Port and the Designated Bridge Ports for the respective network segments. All other ports are blocked, which means that they will not be allowed to receive or forward traffic.

STP Reconfiguration

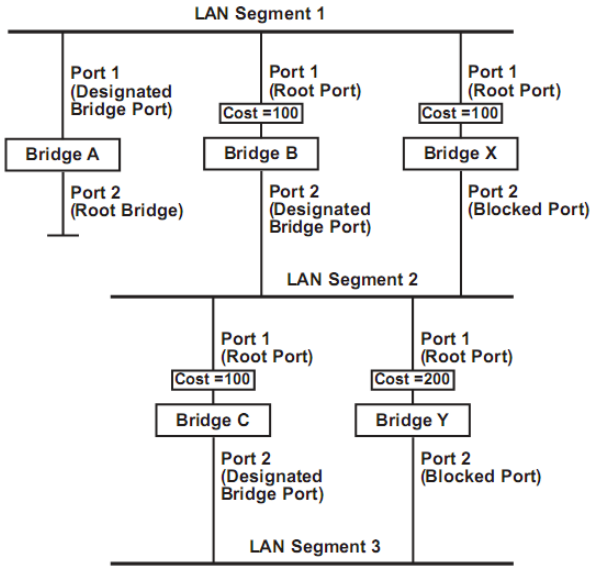
Once the network topology has stabilized, each bridge listens for Hello BPDUs transmitted from the Root Bridge at regular intervals. If a bridge does not receive a Hello BPDU after a certain interval (the Max Age time), the bridge assumes that the Root Bridge, or a link between itself and the Root Bridge, has gone down. This will trigger the bridge to reconfigure the network to account for the change. If you have configured an SNMP trap destination, when the topology of your network changes, the first bridge to detect the change sends out an SNMP trap.

Differences between RSTP and STP

RSTP is similar to STP, but includes additional information in the BPDUs that allow each bridge to confirm that it has taken action to prevent loops from forming when it decides to enable a link to a neighboring bridge. Adjacent bridges connected via point-to-point links will be able to enable a link without waiting to ensure that all other bridges in the network have had time to react to the change. The main benefit of RSTP is that the configuration decision is made locally rather than network-wide, allowing RSTP to carry out automatic configuration and restore a link faster than STP.

STP Example

The LAN shown in the following figure has three segments, with adjacent segments connected using two possible links. The various STP factors, such as Cost, Root Port, Designated Bridge Port, and Blocked Port are shown in the figure.



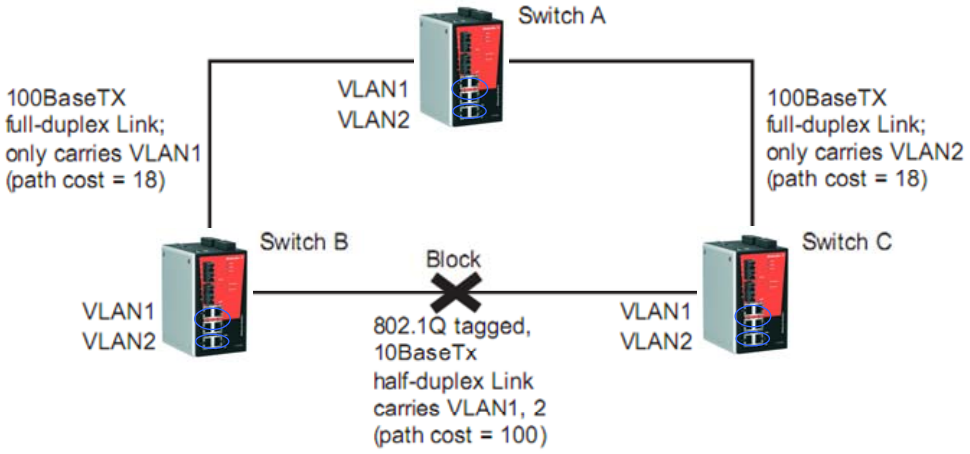
- Bridge A has been selected as the Root Bridge, since it was determined to have the lowest Bridge Identifier on the network.
- Since Bridge A is the Root Bridge, it is also the Designated Bridge for LAN segment 1. Port 1 on Bridge A is selected as the Designated Bridge Port for LAN Segment 1.
- Ports 1 of Bridges B, C, X, and Y are all Root Ports sine they are nearest to the Root Bridge, and therefore have the most efficient path.
- Bridges B and X offer the same Root Path Cost for LAN segment 2. However, Bridge B was selected as the Designated Bridge for that segment since it has a lower Bridge Identifier. Port 2 on Bridge B is selected as the Designated Bridge Port for LAN Segment 2.
- Bridge C is the Designated Bridge for LAN segment 3, because it has the lowest Root Path Cost for LAN Segment 3:
  - The route through Bridges C and B costs 200 (C to B=100, B to A=100)
  - The route through Bridges Y and B costs 300 (Y to B=200, B to A=100)
- The Designated Bridge Port for LAN Segment 3 is Port 2 on Bridge C.

Using STP on a Network with Multiple VLANs

IEEE Std 802.1D, 1998 Edition, does not take into account VLANs when calculating STP information—the calculations only depend on the physical connections. Consequently, some network configurations will result in VLANs being subdivided into a number of isolated sections by the STP system. You must ensure that

every VLAN configuration on your network takes into account the expected STP topology and alternative topologies that may result from link failures.

The following figure shows an example of a network that contains VLANs 1 and 2. The VLANs are connected using the 802.1Q-tagged link between Switch B and Switch C. By default, this link has a port cost of 100 and is automatically blocked because the other Switch-to-Switch connections have a port cost of 36 (18+18). This means that both VLANs are now subdivided—VLAN 1 on Switch units A and B cannot communicate with VLAN 1 on Switch C, and VLAN 2 on Switch units A and C cannot communicate with VLAN 2 on Switch B.

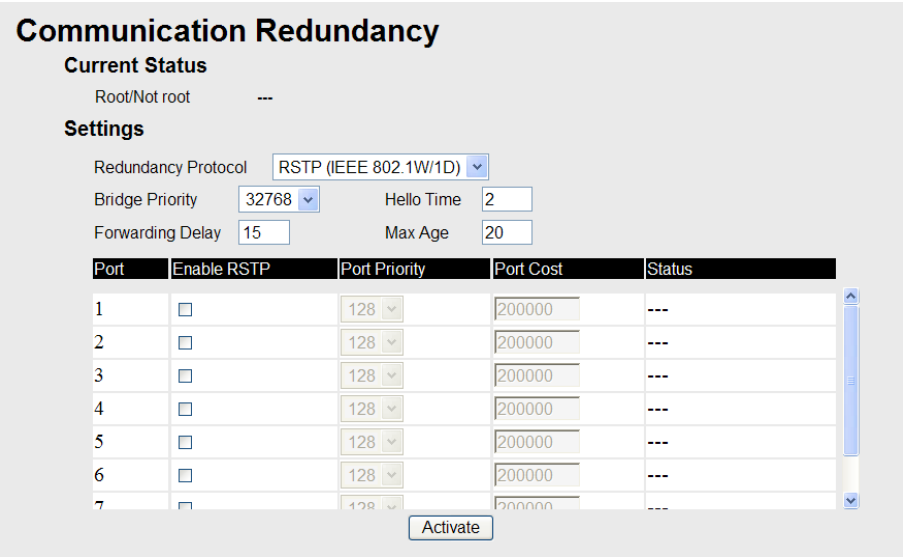


To avoid subdividing VLANs, all inter-switch connections should be made members of all available 802.1Q VLANs. This will ensure connectivity at all times. For example, the connections between Switches A and B, and between Switches A and C should be 802.1Q tagged and carrying VLANs 1 and 2 to ensure connectivity.

See the "Configuring Virtual LANs" section for more information about VLAN Tagging.

Configuring STP/RSTP

The following figures indicate which Spanning Tree Protocol parameters can be configured. A more detailed explanation of each parameter follows.



At the top of this page, the user can check the "Current Status" of this function. For RSTP, you will see:

Now Active:

This will show which communication protocol is being used Turbo Ring, RSTP, or neither.

Root/Not Root

This field will appear only when selected to operate in RSTP mode. It indicates whether or not this IE-SW-PL18M is the Root of the Spanning Tree (the root is determined automatically).

At the bottom of this page, the user can configure the "Settings" of this function. For RSTP, you can configure:

Redundancy Protocol

Setting	Description	Factory Default
Turbo Ring	Select this item to change to the Turbo Ring configuration page.	None
Turbo Ring V2	Select this item to change to the Turbo Ring V2 configuration page.	
Turbo Chain	Select this item to change to the Turbo Chain configuration page.	
RSTP (IEEE 802.1W/1D)	Select this item to change to the RSTP configuration page.	
None	Ring redundancy is not active	

Bridge priority

Setting	Description	Factory Default
Numerical value selected by user	Increase this device's bridge priority by selecting a lower number. A device with a higher bridge priority has a greater chance of being established as the root of the Spanning Tree topology.	32768

Forwarding Delay

Setting	Description	Factory Default
Numerical value input by user	The amount of time this device waits before checking to see if it should change to a different state.	15 (sec.)

Hello time (sec.)

Setting	Description	Factory Default
Numerical value input by user	The root of the Spanning Tree topology periodically sends out a "hello" message to other devices on the network to check if the topology is healthy. The "hello time" is the amount of time the root waits between sending hello messages.	2

Max. Age (sec.)

Setting	Description	Factory Default
Numerical value input by user	If this device is not the root, and it has not received a hello message from the root in an amount of time equal to "Max. Age," then this device will reconfigure itself as a root. Once two or more devices on the network are recognized as a root, the devices will renegotiate to set up a new Spanning Tree topology.	20

Enable STP per Port

Setting	Description	Factory Default
Enable/Disable	Select to enable the port as a node on the Spanning Tree topology.	Disabled

NOTE We suggest not enabling the Spanning Tree Protocol once the port is connected to a device (PLC, RTU, etc.) as opposed to network equipment. The reason is that it will cause unnecessary negotiation.

Port Priority

Setting	Description	Factory Default
Numerical value selected by user	Increase this port's priority as a node on the Spanning Tree topology by entering a lower number.	128

Port Cost

Setting	Description	Factory Default
Numerical value input by user	Input a higher cost to indicate that this port is less suitable as a node for the Spanning Tree topology.	200000

Port Status

Indicates the current Spanning Tree status of this port. "Forwarding" for normal transmission, or "Blocking" to block transmission.

Configuration Limits of RSTP/STP

The Spanning Tree Algorithm places limits on three of the configuration items described previously:
[Eq. 1]: 1 sec Hello Time 10 sec
[Eq. 2]: 6 sec Max. Age 40 sec
[Eq. 3]: 4 sec Forwarding Delay 30 sec

These three variables are further restricted by the following two inequalities:
[Eq. 4]: 2 * (Hello Time + 1 sec) Max. Age 2 * (Forwarding Delay – 1 sec)

The firmware will alert you immediately if any of these restrictions are violated. For example, setting

Hello Time = 5 sec, Max. Age = 20 sec, and Forwarding Delay = 4 sec does not violate Eqs. 1 through 3, but does violate Eq. 4, since in this case,

2 * (Hello Time + 1 sec) = 12 sec, and 2 * (Forwarding Delay – 1 sec) = 6 sec.

You can remedy the situation in many ways. One solution is simply to increase the Forwarding Delay value to at least 11 sec.

HINT: Perform the following steps to avoid guessing:

Step 1: Assign a value to "Hello Time" and then calculate the left most part of Eq. 4 to get the lower limit of "Max. Age."

Step 2: Assign a value to "Forwarding Delay" and then calculate the right most part of Eq. 4 to get the upper limit for "Max. Age."

Step 3: Assign a value to "Forwarding Delay" that satisfies the conditions in Eq. 3 and Eq. 4.

Using Traffic Prioritization

The IE-SW-PL18M's traffic prioritization capability provides Quality of Service (QoS) to your network by making data delivery more reliable. You can prioritize traffic on your network to ensure that high priority data is transmitted with minimum delay. Traffic can be controlled by a set of rules to obtain the required Quality of Service for your network. The rules define different types of traffic and specify how each type should be treated as it passes through the switch. The IE-SW-PL18M can inspect both IEEE 802.1p/1Q layer 2 CoS tags, and even layer 3 TOS information to provide consistent classification of the entire network. The implemented QoS capability improves the performance and determinism of industrial networks for mission critical applications.

The Traffic Prioritization Concept

What is Traffic Prioritization?

Traffic prioritization allows you to prioritize data so that time-sensitive and system-critical data can be transferred smoothly and with minimal delay over a network. The benefits of using traffic prioritization are:

- Improve network performance by controlling a wide variety of traffic and managing congestion.
- Assign priorities to different categories of traffic. For example, set higher priorities for time-critical or business-critical applications.
- Provide predictable throughput for multimedia applications, such as video conferencing or voice over IP, and minimize traffic delay and jitter.
- Improve network performance as the amount of traffic grows. This will save cost by reducing the need to keep adding bandwidth to the network.

How Traffic Prioritization Works

Traffic prioritization uses the four traffic queues that are present in your IE-SW-PL18M to ensure that high priority traffic is forwarded on a different queue from lower priority traffic. This is what provides Quality of Service (QoS) to your network.

The traffic prioritization depends on two industry-standard methods:

- **IEEE 802.1D**—a layer 2 marking scheme.
- **Differentiated Services (DiffServ)**—a layer 3 marking scheme.

IEEE 802.1D Traffic Marking

The IEEE Std 802.1D, 1998 Edition marking scheme, which is an enhancement to IEEE Std 802.1D, enables Quality of Service on the LAN. Traffic service levels are defined in the IEEE 802.1Q 4-byte tag, which is used to carry VLAN identification as well as IEEE 802.1p priority information. The 4-byte tag immediately follows the destination MAC address and Source MAC address.

The IEEE Std 802.1D, 1998 Edition priority marking scheme assigns an IEEE 802.1p priority level between 0 and 7 to each frame. This determines the level of service that that type of traffic should receive. Refer to the table below for an example of how different traffic types can be mapped to the eight IEEE 802.1p priority levels.

IEEE 802.1p Priority Level	IEEE 802.1D Traffic Type
0	Best Effort (default)
1	Background
2	Standard (spare)
3	Excellent Effort (business critical)
4	Controlled Load (streaming multimedia)
5	Video (interactive media); less than 100 milliseconds of latency and jitter
6	Voice (interactive voice); less than 10 milliseconds of latency and jitter
7	Network Control Reserved traffic

Even though the IEEE 802.1D standard is the most widely used prioritization scheme in the LAN environment, it still has some restrictions:

- It requires an additional 4-byte tag in the frame, which is normally optional in Ethernet networks. Without this tag, the scheme cannot work.
- The tag is part of the IEEE 802.1Q header, so to implement QoS at layer 2, the entire network must implement IEEE 802.1Q VLAN tagging.

It is only supported on a LAN and not routed across WAN links, since the IEEE 802.1Q tags are removed when the packets pass through a router.

Differentiated Services (DiffServ) Traffic Marking

DiffServ is a Layer 3 marking scheme that uses the DiffServ Code Point (DSCP) field in the IP header to store the packet priority information. DSCP is an advanced intelligent method of traffic marking as you can choose how your network prioritizes different types of traffic. DSCP uses 64 values that map to user-defined service levels, allowing you to establish more control over network traffic.

Advantages of DiffServ over IEEE 802.1D are:

- Configure how you want your switch to treat selected applications and types of traffic by assigning various grades of network service to them.
- No extra tags are required in the packet.
- DSCP uses the IP header of a packet and therefore priority is preserved across the Internet.
- DSCP is backward compatible with IPV4 TOS, which allows operation with existing devices that use a layer 3 TOS enabled prioritization scheme.

Traffic Prioritization

The IE-SW-PL18M classifies traffic based on layer 2 of the OSI 7 layer model, and the switch prioritizes received traffic according to the priority information defined in the received packet. Incoming traffic is classified based upon the IEEE 802.1D frame and is assigned to the appropriate priority queue based on the IEEE 802.1p service level value defined in that packet. Service level markings (values) are defined in the IEEE 802.1Q 4-byte tag, and consequently traffic will only contain 802.1p priority markings if the network is configured with VLANs and VLAN tagging. The traffic flow through the switch is as follows:

A received packet may or may not have an 802.1p tag associated with it. If it does not, then it is given a default 802.1p tag (which is usually 0). Alternatively, the packet may be marked with a new 802.1p value, which will result in all knowledge of the old 802.1p tag being lost.

As the 802.1p priority levels are fixed to the traffic queues, the packet will be placed in the appropriate priority queue, ready for transmission through the appropriate egress port. When the packet reaches the head of its queue and is about to be transmitted, the device determines whether or not the egress port is tagged for that VLAN. If it is, then the new 802.1p tag is used in the extended 802.1D header.

The Ethernet Switch will check a packet received at the ingress port for IEEE 802.1D traffic classification, and then prioritize it based upon the IEEE 802.1p value (service levels) in that tag. It is this 802.1p value that determines to which traffic queue the packet is mapped.

Traffic Queues

The IE-SW-PL18M hardware has multiple traffic queues that allow packet prioritization to occur. Higher priority traffic can pass through without being delayed by lower priority traffic. As each packet arrives in the IE-SW-PL18M, it passes through any ingress processing (which includes classification, marking/re-marking), and is then sorted into the appropriate queue. The switch then forwards packets from each queue.

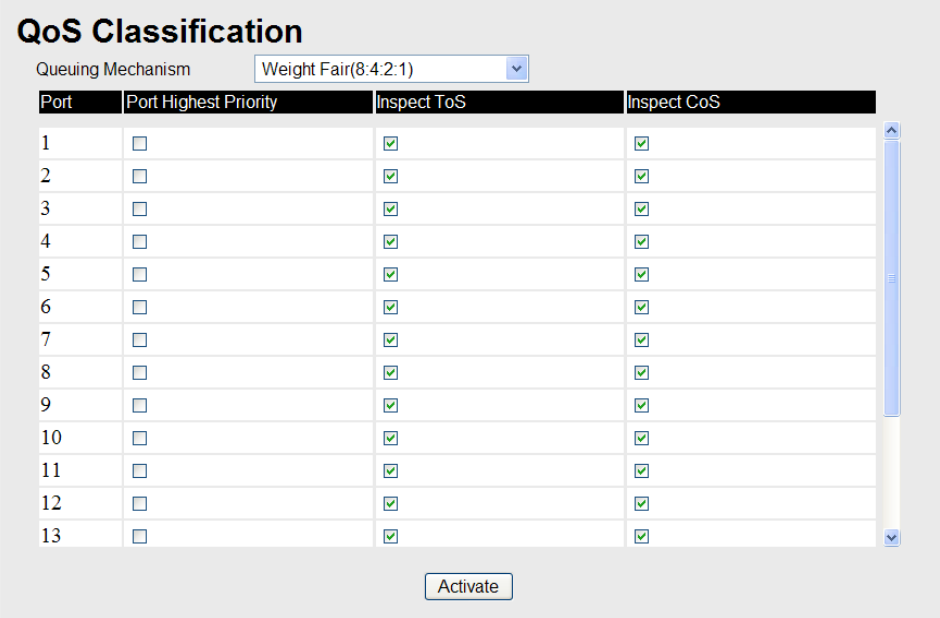
The IE-SW-PL18M supports two different queuing mechanisms:

- **Weight Fair:** This method services all the traffic queues, giving priority to the higher priority queues. Under most circumstances, this method gives high priority precedence over low-priority, but in the event that high-priority traffic exceeds the link capacity, lower priority traffic is not blocked.
- **Strict:** This method services high traffic queues first; low priority queues are delayed until no more high priority data needs to be sent. This method always gives precedence to high priority over low-priority.

Configuring Traffic Prioritization

Quality of Service (QoS) provides a traffic prioritization capability to ensure that important data is delivered consistently and predictably. The Ethernet Switch can inspect IEEE 802.1p/1Q layer 2 CoS tags, and even layer 3 TOS information, to provide a consistent classification of the entire network. The implemented QoS capability improves your industrial network's performance and determinism for mission critical applications.

QoS Classification



The IE-SW-PL18M supports inspection of layer 3 TOS and/or layer 2 CoS tag information to determine how to classify traffic packets.

Queuing Mechanism

Setting	Description	Factory Default
Weighted Fair	The IE-SW-PL18M has 4 priority queues. In the weighted fair scheme, an 8, 4, 2, 1 weighting is applied to the four priorities. This approach prevents the lower priority frames from being starved of opportunity for transmission with only a slight delay to the higher priority frames.	Weight Fair
Strict	In the Strict-priority scheme, all top-priority frames egress a port until that priority's queue is empty, and then the next lower priority queue's frames egress. This approach can cause the lower priorities to be starved of opportunity for transmitting any frames but ensures all high priority frames to egress the switch as soon as possible.	

Port Highest Priority

Setting	Description	Factory Default
Enable/Disable	Set the Port Priority of the ingress frames to "High" queues.	Disable

Inspect TOS

Setting	Description	Factory Default
Enable/Disable	Select the option to enable the Switch to inspect the Type of Service (TOS) bits in IPV4 frame to determine the priority of each frame.	Enable

Inspect COS

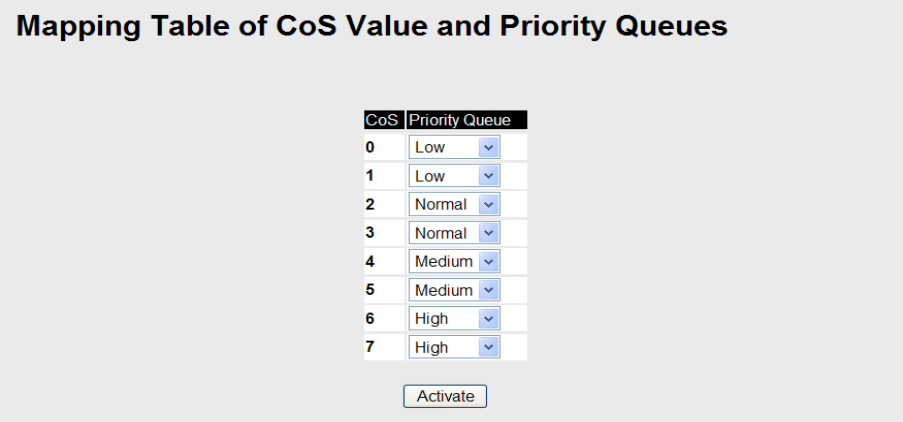
Setting	Description	Factory Default
Enable/Disable	Select the option to enable the Switch to inspect the 802.1p COS tag in the MAC frame to determine the priority of each frame.	Enable

NOTE The priority of an ingress frame is determined in order by:

1. Inspect TOS
2. Inspect CoS
3. Port Highest Priority

NOTE The designer can enable these classifications individually or in combination. For instance, if a 'hot,' higher priority port is required for a network design, "Inspect TOS" and "Inspect CoS" can be disabled. This setting leaves only port default priority active, which results in all ingress frames being assigned the same priority on that port.

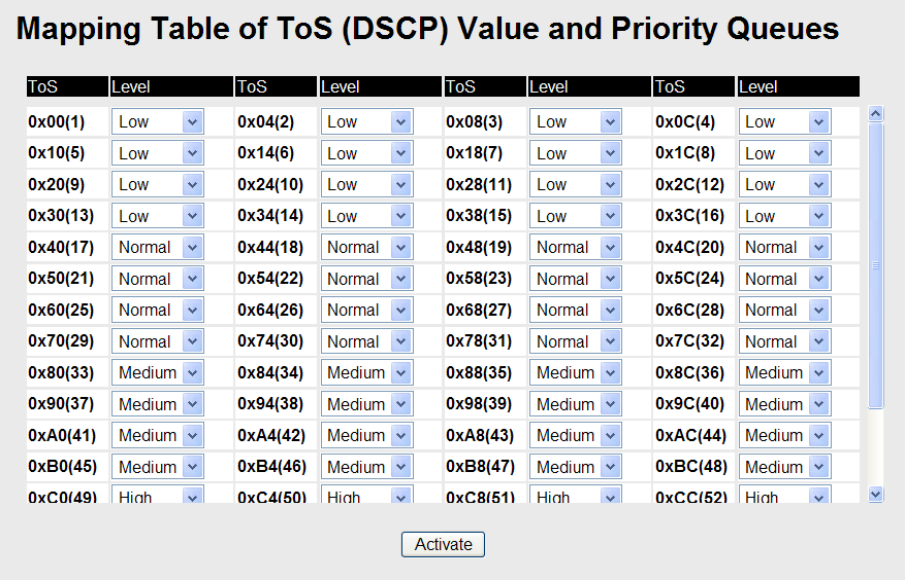
CoS Mapping



CoS Value and Priority Queues

Setting	Description	Factory
Low/Normal/ Medium/High	Set the mapping table of different CoS values to 4 different egress queues.	0: Low 1: Low 2: Normal 3: Normal 4: Medium 5: Medium 6: High 7: High

TOS/DiffServ Mapping


Mapping Table of ToS (DSCP) Value and Priority Queues
ToS Level ToS Level ToS Level ToS Level
0x00(1) Low 0x04(2) Low 0x08(3) Low 0x0C(4) Low
0x10(5) Low 0x14(6) Low 0x18(7) Low 0x1C(8) Low
0x20(9) Low 0x24(10) Low 0x28(11) Low 0x2C(12) Low
0x30(13) Low 0x34(14) Low 0x38(15) Low 0x3C(16) Low
0x40(17) Normal 0x44(18) Normal 0x48(19) Normal 0x4C(20) Normal
0x50(21) Normal 0x54(22) Normal 0x58(23) Normal 0x5C(24) Normal
0x60(25) Normal 0x64(26) Normal 0x68(27) Normal 0x6C(28) Normal
0x70(29) Normal 0x74(30) Normal 0x78(31) Normal 0x7C(32) Normal
0x80(33) Medium 0x84(34) Medium 0x88(35) Medium 0x8C(36) Medium
0x90(37) Medium 0x94(38) Medium 0x98(39) Medium 0x9C(40) Medium
0xA0(41) Medium 0xA4(42) Medium 0xA8(43) Medium 0xAC(44) Medium
0xB0(45) Medium 0xB4(46) Medium 0xB8(47) Medium 0xBC(48) Medium
0xC0(49) High 0xC4(50) High 0xC8(51) High 0xCC(52) High
Activate

ToS (DSCP) Value and Priority Queues

Setting	Description	Factory Default
Low/Normal/ Medium/High	Set the mapping table of different TOS values to 4 different egress queues.	1 to 16: Low 17 to 32: Normal 33 to 48: Medium 49 to 64: High

Using Virtual LAN

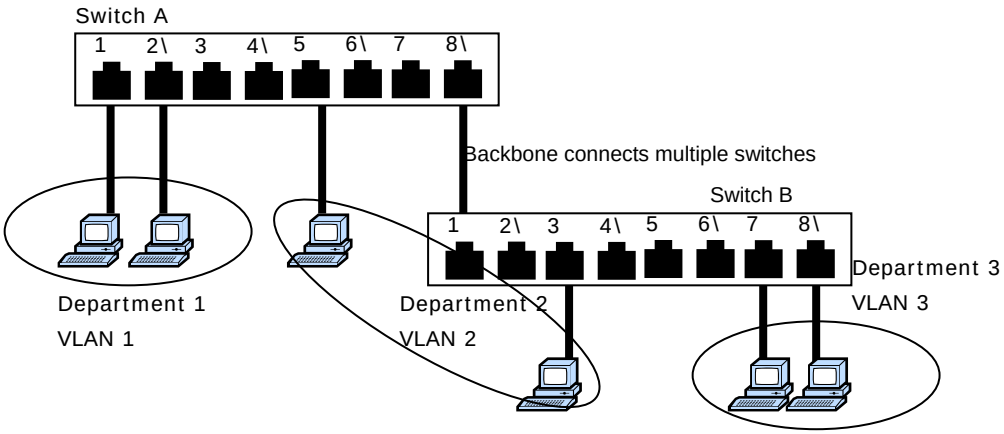
Setting up Virtual LANs (VLANs) on your IE-SW-PL18M increases the efficiency of your network by dividing the LAN into logical segments, as opposed to physical segments. In general, VLANs are easier to manage.

The Virtual LAN (VLAN) Concept

What is a VLAN?

A VLAN is a group of devices that can be located anywhere on a network, but which communicate as if they are on the same physical segment. With VLANs, you can segment your network without being restricted by physical connections—a limitation of traditional network design. As an example, with VLANs you can segment your network according to:

- **Departmental groups**—You could have one VLAN for the Marketing department, another for the Finance department, and another for the Development department.
- **Hierarchical groups**—You could have one VLAN for directors, another for managers, and another for general staff.
- **Usage groups**—You could have one VLAN for e-mail users, and another for multimedia users.



Benefits of VLANs

The main benefit of VLANs is that they provide a network segmentation system that is far more flexible than traditional networks. Using VLANs also provides you with three other benefits:

- **VLANs ease the relocation of devices on networks:** With traditional networks, network administrators spend most of their time dealing with moves and changes. If users move to a different subnetwork, the addresses of each host must be updated manually. With a VLAN setup, if a host on VLAN Marketing, for example, is moved to a port in another part of the network, and retains its original subnet membership, you only need to specify that the new port is on VLAN Marketing. You do not need to carry out any re-cabling.
- **VLANs provide extra security:** Devices within each VLAN can only communicate with other devices on the same VLAN. If a device on VLAN Marketing needs to communicate with devices on VLAN Finance, the traffic must pass through a routing device or Layer 3 switch.
- **VLANs help control traffic:** With traditional networks, congestion can be caused by broadcast traffic that is directed to all network devices, regardless of whether or not they need it. VLANs increase the efficiency of your network because each VLAN can be set up to contain only those devices that need to communicate with each other.

VLANs and Ethernet Switch

Your IE-SW-PL18M provides support for VLANs using IEEE Std 802.1Q-1998. This standard allows traffic from multiple VLANs to be carried across one physical link. The IEEE Std 802.1Q-1998 standard allows each port on your IE-SW-PL18M to be placed in:

- Any one VLAN defined on the IE-SW-PL18M.
- Several VLANs at the same time using 802.1Q tagging.

The standard requires that you define the *802.1Q VLAN ID* for each VLAN on your IE-SW-PL18M before the switch can use it to forward traffic:

Managing a VLAN

A new or initialized IE-SW-PL18M contains a single VLAN—the Default VLAN. This VLAN has the following definition:

- *VLAN Name*—Management VLAN
- *802.1Q VLAN ID*—1 (if tagging is required)

All the ports are initially placed on this VLAN, and it is the only VLAN that allows you to access the management software of the IE-SW-PL18M over the network.

Communication between VLANs

If devices connected to a VLAN need to communicate to devices on a different VLAN, a router or Layer 3 switching device with connections to both VLANs needs to be installed. Communication between VLANs can only take place if they are all connected to a routing or Layer 3 switching device.

VLANs: Tagged and Untagged Membership

The IE-SW-PL18M supports 802.1Q VLAN tagging, a system that allows traffic for multiple VLANs to be carried on a single physical (backbone, trunk) link. When setting up VLANs you need to understand when to use untagged and tagged membership of VLANs. Simply put, if a port is on a single VLAN it can be an untagged member, but if the port needs to be a member of multiple VLANs, tagged membership must be defined.

A typical host (e.g., clients) will be untagged members of one VLAN, defined as "Access Port" in the IE-SW-PL18M, while inter-switch connections will be tagged members of all VLANs, defined as "Trunk Port" in the IE-SW-PL18M.

The IEEE Std 802.1Q-1998 defines how VLANs operate within an open packet-switched network. An 802.1Q compliant packet carries additional information that allows a switch to determine which VLAN the port belongs. If a frame is carrying the additional information, it is known as a *tagged* frame.

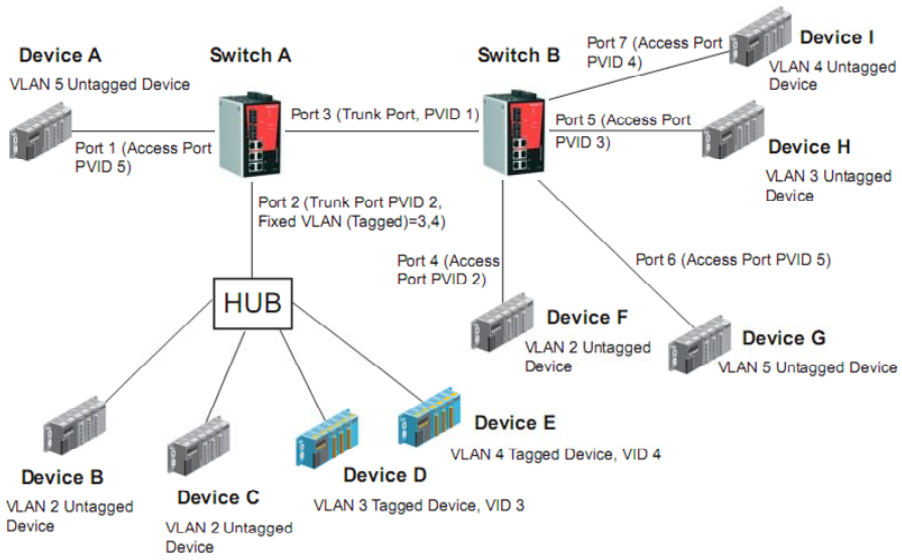
To carry multiple VLANs across a single physical (backbone, trunk) link, each packet must be tagged with a VLAN identifier so that the switches can identify which packets belong to which VLAN. To communicate between VLANs, a router must be used.

The Ethernet Switch supports two types of VLAN port settings:

- **Access Port:** The port connects to a single device that is not tagged. The user must define the default port PVID that determines to which VLAN the device belongs. Once the ingress packet of this Access Port egresses to another Trunk Port (the port needs all packets to carry tag information), the IE-SW-PL18M will insert this PVID into this packet to help the next 802.1Q VLAN switch recognize it.
- **Trunk Port:** The port connects to a LAN that consists of untagged devices/tagged devices and/or switches and hubs. In general, the traffic of the Trunk Port must have a Tag. Users can also assign PVID to a Trunk Port. The untagged packet on the Trunk Port will be assigned the port default PVID as its VID.

The following section illustrates how to use these ports to set up different applications.

Sample Applications of VLANs using the IE-SW-PL18M



In this application,

- Port 1 connects a single untagged device and assigns it to VLAN 5; it should be configured as "Access Port" with PVID 5.
- Port 2 connects a LAN with two untagged devices belonging to VLAN 2. One tagged device with VID 3 and one tagged device with VID 4. It should be configured as "Trunk Port" with PVID 2 for untagged device and Fixed VLAN (Tagged) with 3 and 4 for tagged device. Since each port can only have one unique PVID, all untagged devices on the same port can only belong to the same VLAN.
- Port 3 connects with another switch. It should be configured as "Trunk Port." GVRP protocol will be used through the Trunk Port.
- Port 4 connects a single untagged device and assigns it to VLAN 2; it should be configured as "Access Port" with PVID 2.
- Port 5 connects a single untagged device and assigns it to VLAN 3; it should be configured as "Access Port" with PVID 3.
- Port 6 connect a single untagged device and assigns it to VLAN 5; it should be configured as "Access Port" with PVID 5.
- Port 7 connects a single untagged device and assigns it to VLAN 4; it should be configured as "Access Port" with PVID 4.

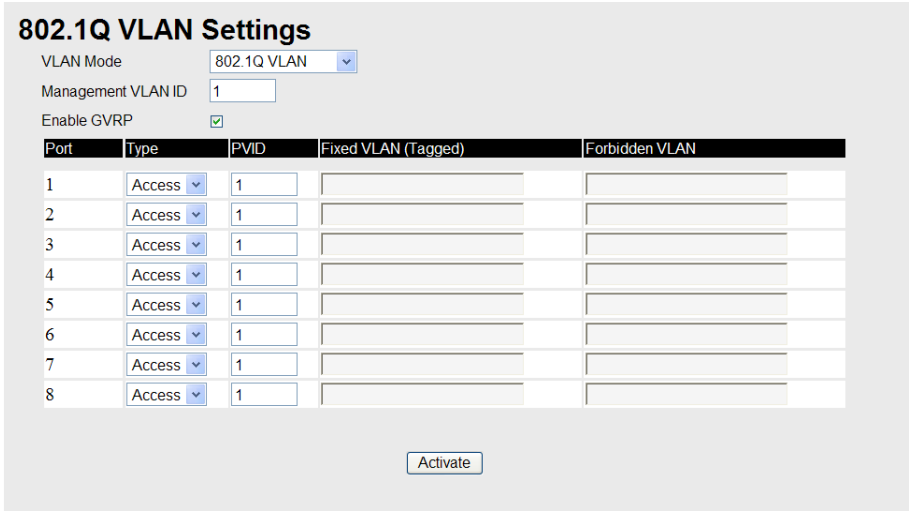
After proper configuration:

- Packets from device A will travel through "Trunk Port 3" with tagged VID 5. Switch B will recognize its VLAN, pass it to port 6, and then remove tags received successfully by device G, and vice versa.
- Packets from device B and C will travel through "Trunk Port 3" with tagged VID 2. Switch B recognizes its VLAN, passes it to port 4, and then removes tags received successfully by device F, and vice versa.
- Packets from device D will travel through "Trunk Port 3" with tagged VID 3. Switch B will recognize its VLAN, pass to port 5, and then remove tags received successfully by device H. Packets from device H will travel through "Trunk Port 3" with PVID 3. Switch A will recognize its VLAN and pass it to port 2, but will not remove tags received successfully by device D.
- Packets from device E will travel through "Trunk Port 3" with tagged VID 4. Switch B will recognize its VLAN, pass it to port 7, and then remove tags received successfully by device I. Packets from device I will travel through "Trunk Port 3" with tagged VID 4. Switch A will recognize its VLAN and pass it to port 2, but will not remove tags received successfully by device E.

Configuring Virtual LAN

VLAN Settings

To configure the IE-SW-PL18M's **802.1Q VLAN**, use the VLAN Setting page to configure the ports.



VLAN Mode

Setting	Description	Factory Default
802.1Q VLAN	Set VLAN mode to 802.1Q VLAN	802.1Q VLAN
Port-based VLAN	Set VLAN mode to Port-based VLAN	

Management VLAN ID

Setting	Description	Factory Default
VLAN ID ranges from 1 to 4094	Set the management VLAN of this IE-SW-PL18M.	1

Port Type

Setting	Description	Factory Default
Access	This port type is used to connect single devices without tags.	Access
Trunk	Select "Trunk" port type to connect another 802.1Q VLAN aware switch or another LAN that combines tagged and/or untagged devices and/or other switches/hubs.	

ATTENTION

For communication redundancy in the VLAN environment, set "Redundant Port," "Coupling Port," and "Coupling Control Port" as "Trunk Port," since these ports act as the "backbone" to transmit all packets of different VLANs to different IE-SW-PL18M units.

Port PVID

Setting	Description	Factory Default
VID range from 1 to 4094	Set the port default VLAN ID for untagged devices that connect to the port.	1

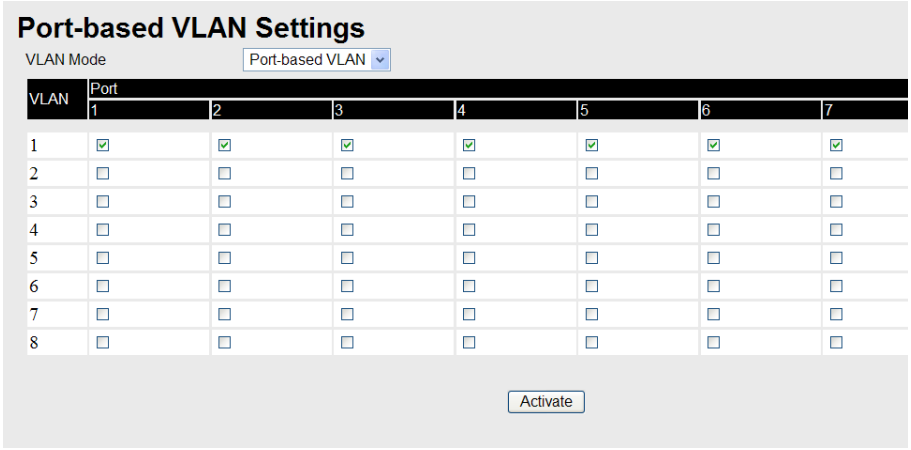
Fixed VLAN List (Tagged)

Setting	Description	Factory Default
VID range from 1 to 4094	This field will be active only when selecting the "Trunk" port type. Set the other VLAN ID for tagged devices that connect to the "Trunk" port. Use commas to separate different VIDs.	None

Forbidden VLAN List

Setting	Description	Factory Default
VID range from 1 to 4094	This field will be active only when selecting the "Trunk" port type. Set the VLAN IDs that will not be supported by this trunk port. Use commas to separate different VIDs.	None

To configure the **Port-based VLAN**, use the VLAN Setting page to configure the ports.



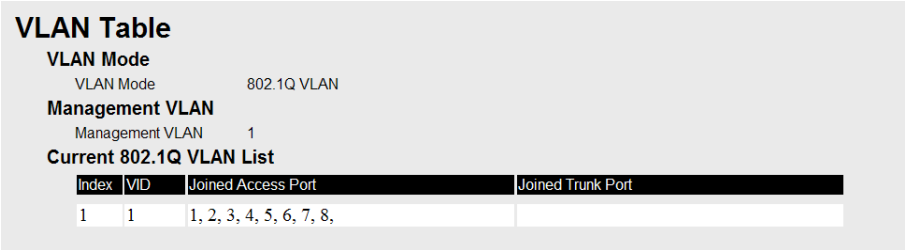
VLAN Mode

Setting	Description	Factory Default
802.1Q VLAN	Set VLAN mode to 802.1Q VLAN	802.1Q VLAN
Port-based VLAN	Set VLAN mode to Port-based VLAN	

Port

Setting	Description	Factory Default
Enable/Disable	Set port to specific VLAN Group.	Enable (all ports belong to VLAN1)

VLAN Table


VLAN Table
VLAN Mode
VLAN Mode 802.1Q VLAN
Management VLAN
Management VLAN 1
Current 802.1Q VLAN List
Index VID Joined Access Port Joined Trunk Port
1 1 1, 2, 3, 4, 5, 6, 7, 8,

In 802.1Q VLAN table, you can review the VLAN groups that were created, Joined Access Ports, and Trunk Ports, and in Port-based VLAN table, you can review the VLAN group and Joined port.

NOTE The physical network can have a maximum of 64 VLAN settings.

Using Multicast Filtering

Multicast filtering improves the performance of networks that carry multicast traffic. This section explains multicasts, multicast filtering, and how multicast filtering can be implemented on your IE-SW-PL18M.

The Concept of Multicast Filtering

What is an IP Multicast?

A *multicast* is a packet sent by one host to multiple hosts. Only those hosts that belong to a specific multicast group will receive the multicast. If the network is set up correctly, a multicast can only be sent to an end-station or a subset of end-stations on a LAN or VLAN that belong to the multicast group. Multicast group members can be distributed across multiple subnets, so that multicast transmissions can occur within a campus LAN or over a WAN. In addition, networks that support IP multicast send only *one* copy of the desired information across the network until the delivery path that reaches group members diverges. To make more efficient use of network bandwidth, it is only at these points that multicast packets are duplicated and forwarded. A multicast packet has a multicast group address in the destination address field of the packet's IP header.

Benefits of Multicast

The benefits of using IP multicast are that it:

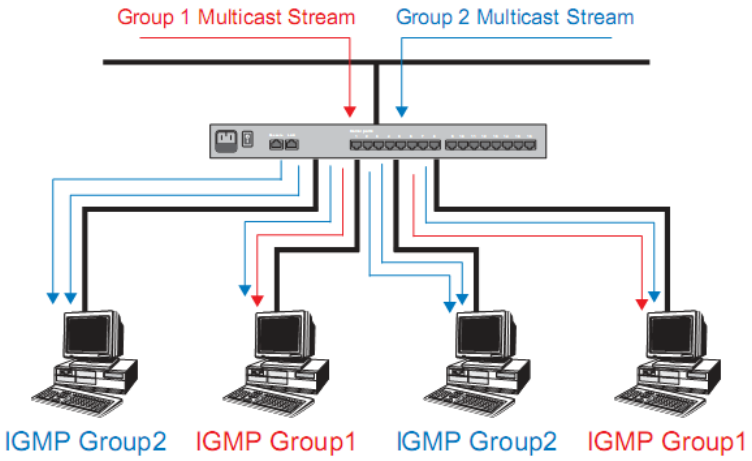
- Uses the most efficient, sensible method to deliver the same information to many receivers with only one transmission.
- Reduces the load on the source (for example, a server) since it will not need to produce several copies of the same data.
- Makes efficient use of network bandwidth and scales well as the number of multicast group members increases.
- Works with other IP protocols and services, such as Quality of Service (QoS).

Multicast transmission makes more sense and is more efficient than unicast transmission for some applications. For example, multicasts are often used for video-conferencing, since high volumes of traffic must be sent to several end-stations at the same time, but where broadcasting the traffic to all end-stations would cause a substantial reduction in network performance. Furthermore, several industrial automation protocols, such as Allen-Bradley, EtherNet/IP, Siemens Profibus, and Foundation Fieldbus HSE (High Speed Ethernet), use multicast. These industrial Ethernet protocols use publisher/subscriber communications models by multicasting packets that could flood a network with heavy traffic. IGMP Snooping is used to prune multicast traffic so that it travels only to those end destinations that require the traffic, reducing the amount of traffic on the Ethernet LAN.

Multicast Filtering

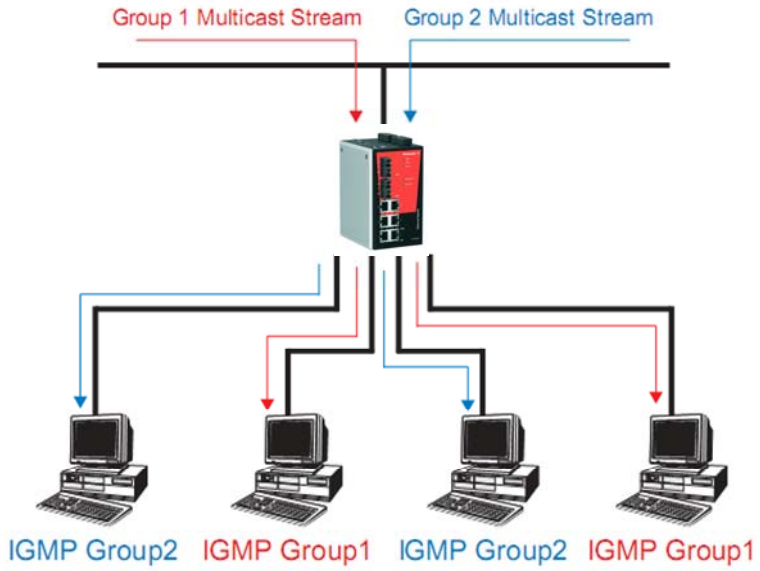
Multicast filtering ensures that only end-stations that have joined certain groups receive multicast traffic. With multicast filtering, network devices only forward multicast traffic to the ports that are connected to registered end-stations. The following two figures illustrate how a network behaves without multicast filtering, and with multicast filtering.

Network without multicast filtering



All hosts receive the multicast traffic, even if they don't need it.

Network with multicast filtering



Hosts only receive dedicated traffic from other hosts belonging to the same group.

Multicast Filtering and Ethernet Switch

The IE-SW-PL18M has three ways to achieve multicast filtering: IGMP (Internet Group Management Protocol) Snooping, GMRP (GARP Multicast Registration Protocol), and adding a static multicast MAC manually to filter multicast traffic automatically.

IGMP (Internet Group Management Protocol)

Snooping Mode

Snooping Mode allows your switch to forward multicast packets only to the appropriate ports. The switch "snoops" on exchanges between hosts and an IGMP device, such as a router, to find those ports that want to join a multicast group, and then configure its filters accordingly.

Query Mode

Query mode allows the IE-SW-PL18M to work as the Querier if it has the lowest IP address on the subnetwork to which it belongs. IGMP querying is enabled by default on the IE-SW-PL18M to help prevent interoperability issues with some multicast routers that may not follow the lowest IP address election method. Enable query mode to run multicast sessions on a network that does not contain IGMP routers (or queriers).

NOTE The IE-SW-PL18M is compatible with any device that conforms to the IGMP v2 device protocol.

IGMP Multicast Filtering

IGMP is used by IP-supporting network devices to register hosts with multicast groups. It can be used on all LANs and VLANs that contain a multicast capable IP router, and on other network devices that support multicast filtering. IGMP works as follows:

1. The IP router (or querier) periodically sends query packets to all end-stations on the LANs or VLANs that are connected to it. For networks with more than one IP router, the router with the lowest IP address is the querier. A switch with IP address lower than the IP address of any other IGMP queriers connected to the LAN or VLAN can become the IGMP querier.
2. When an IP host receives a query packet, it sends a report packet back that identifies the multicast group that the end-station would like to join.

3. When the report packet arrives at a port on a switch with IGMP Snooping enabled, the switch knows that the port should forward traffic for the multicast group, and then proceeds to forward the packet to the router.
4. When the router receives the report packet, it registers that the LAN or VLAN requires traffic for the multicast groups.
5. When the router forwards traffic for the multicast group to the LAN or VLAN, the switches only forward the traffic to ports that received a report packet.

GMRP (GARP Multicast Registration Protocol)

The IE-SW-PL18M supports IEEE 802.1D-1998 GMRP (GARP Multicast Registration Protocol), which differs from IGMP (Internet Group Management Protocol). GMRP is a MAC-based multicast management protocol, whereas IGMP is IP-based. GMRP provides a mechanism that allows bridges and end stations to register or de-register Group membership information dynamically. GMRP functions similarly to GVRP, except that GMRP registers multicast addresses on ports. When a port receives a ***GMRP-join*** message, it will register the multicast address to its database if the multicast address is not registered, and all the multicast packets with that multicast address are able to be forwarded from this port. When a port receives a ***GMRP-leave*** message, it will de-register the multicast address from its database, and all the multicast packets with this multicast address are not able to be forwarded from this port.

Static Multicast MAC

Some devices may only support multicast packets, but not support either IGMP Snooping or GMRP. The IE-SW-PL18M supports adding multicast groups manually to enable multicast filtering.

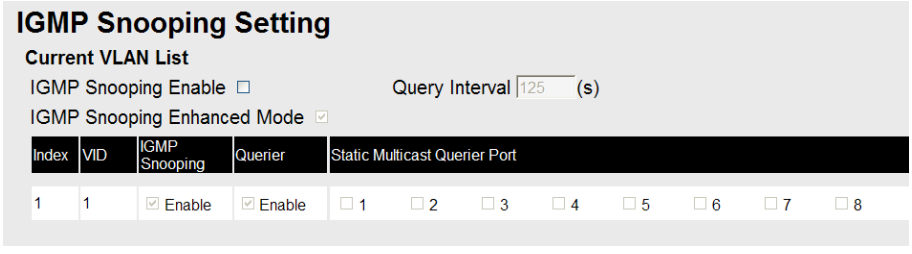
Enabling Multicast Filtering

Use the serial console or Web interface to enable or disable IGMP Snooping and IGMP querying. If IGMP Snooping is not enabled, then IP multicast traffic is always forwarded, flooding the network.

Configuring IGMP Snooping

IGMP Snooping provides the ability to prune multicast traffic so that it travels only to those end destinations that require that traffic, thereby reducing the amount of traffic on the Ethernet LAN.

IGMP Snooping Settings



IGMP Snooping Enable

Setting	Description	Factory Default
Enable/Disable	Select the option to enable the IGMP Snooping function globally.	Disabled

IGMP Snooping Enhanced Mode

Setting	Description	Factory Default
Enable	IGMP Multicast packets will forward to: Learned Multicast Querier Ports Member Ports	Enable
Disable	IGMP Multicast packets will forward to: Learned multicast Querier Ports Static Multicast Querier Ports Querier Connected Ports Member Ports	

Query Interval

Setting	Description	Factory Default
Numerical value input by user	Set the query interval of the Querier function globally. Valid settings are from 20 to 600 seconds.	125 seconds

IGMP Snooping

Setting	Description	Factory Default
Enable/Disable	Select the option to enable the IGMP Snooping function per VLAN.	Enabled if IGMP Snooping Enabled Globally

NOTE We suggest the following IGMP Snooping configurations

When the network is mixed with third party switches, such as Cisco:

- IGMP Snooping Enable—Enable
- IGMP Snooping Enhanced Mode—Disable

When the network consists entirely of Weidmüller switches:

- IGMP Snooping Enable—Enable
- IGMP Snooping Enhanced Mode—Disable

Querier

Setting	Description	Factory Default
Enable/Disable	Select the option to enable the querier function.	Enabled if IGMP Snooping is Enabled Globally

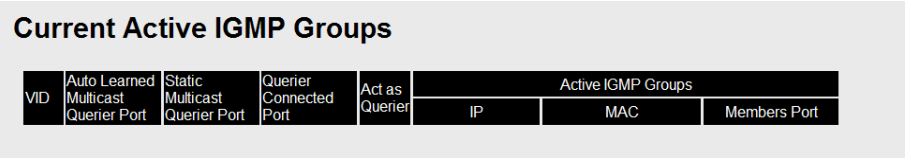
Static Multicast Router Port

Setting	Description	Factory Default
Select/Deselect	Select the option to select which ports will connect to the multicast routers. It's active only when IGMP Snooping is enabled.	Disabled

NOTE At least one switch must be designated the Querier or enable IGMP snooping and GMRP when enabling Turbo Ring and IGMP snooping simultaneously.

IGMP Table

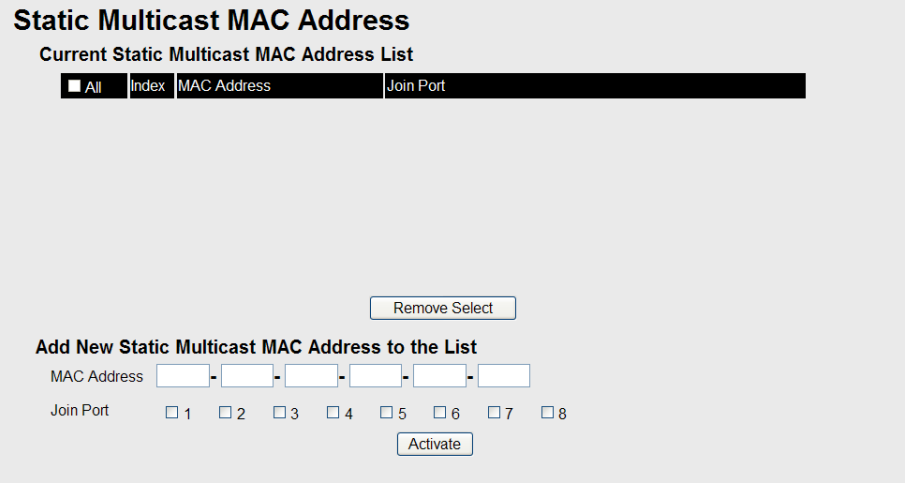
The IGMP table displays the current active IGMP groups that were detected.



The information includes **VID**, **Auto-learned Multicast Router Port**, **Static Multicast Router Port**, **Querier Connected Port**, and the **IP** and **MAC** addresses of active IGMP groups.

Static Multicast MAC

If required, the IE-SW-PL18M also supports adding multicast groups manually.



Add New Static Multicast Address to the List

Setting	Description	Factory Default
MAC Address	Input the multicast MAC address of this host.	None

MAC Address

Setting	Description	Factory Default
integer	Input the number of the VLAN to which the host with this MAC Address belongs.	None

Join Port

Setting	Description	Factory Default
Select/Deselect	Select the appropriate options to select the join ports for this multicast group.	None

Configuring GMRP

GMRP is a MAC-based multicast management protocol, whereas IGMP is IP-based. GMRP provides a mechanism that allows bridges and end stations to register or un-register Group membership information dynamically.

GMRP enable

Setting	Description	Factory Default
Enable/Disable	Select the option to enable the GMRP function for the port listed in the Port column	Disable

GMRP Table

The GMRP table displays the current active GMRP groups that were detected.

Setting	Description
Fixed Ports	This multicast address is defined by static multicast.
Learned Ports	This multicast address is learned by GMRP.

Using Bandwidth Management

In general, one host should not be allowed to occupy unlimited bandwidth, particularly when the device malfunctions. For example, so-called "broadcast storms" could be caused by an incorrectly configured topology, or a malfunctioning device. The IE-SW-PL18M does not only prevents broadcast storms, but can also be configured to a different ingress rate for all packets, giving administrators full control of their limited bandwidth to prevent undesirable effects caused by unpredictable faults.

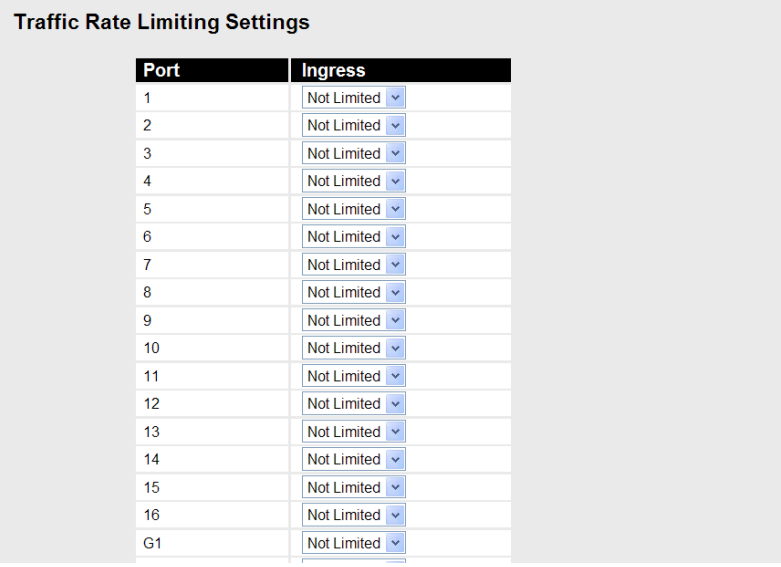
Configuring Bandwidth Management

Broadcast Storm Protection

Enable/Disable

Setting	Description	Factory Default
Enable/Disable	Enables or disables Broadcast Storm Protection for unknown broadcast packet globally	Enable
	Enables or disables Broadcast Storm Protection for unknown multicast packets globally	Disable

Traffic Rate Limiting Settings



Ingress

Setting	Description	Factory Default
Ingress rate	Select the ingress rate for all packets from the following options: not limited, 3%, 5%, 10%, 15%, 25%, 35%, 50%, 65%, 85%	N/A

Using Port Access Control

The Ethernet Switch provides two kinds of Port-Based Access Controls. One is Static Port Lock and the other is IEEE 802.1X.

Static Port Lock

The Ethernet Switch can also be configured to protect static MAC addresses for a specific port. With the Port Lock function, these locked ports will not learn any additional addresses, but only allow traffic from preset static MAC addresses, helping to block crackers and careless usage.

IEEE 802.1X

The IEEE 802.1X standard defines a protocol for client/server-based access control and authentication. The protocol restricts unauthorized clients from connecting to a LAN through ports that are open to the Internet, and which otherwise would be readily accessible. The purpose of the authentication server is to check each client that requests access to the port. The client is only allowed access to the port if the client's permission is authenticated.

The IEEE 802.1X Concept

Three components are used to create an authentication mechanism based on 802.1X standards: Client/Supplicant, Authentication Server, and Authenticator.

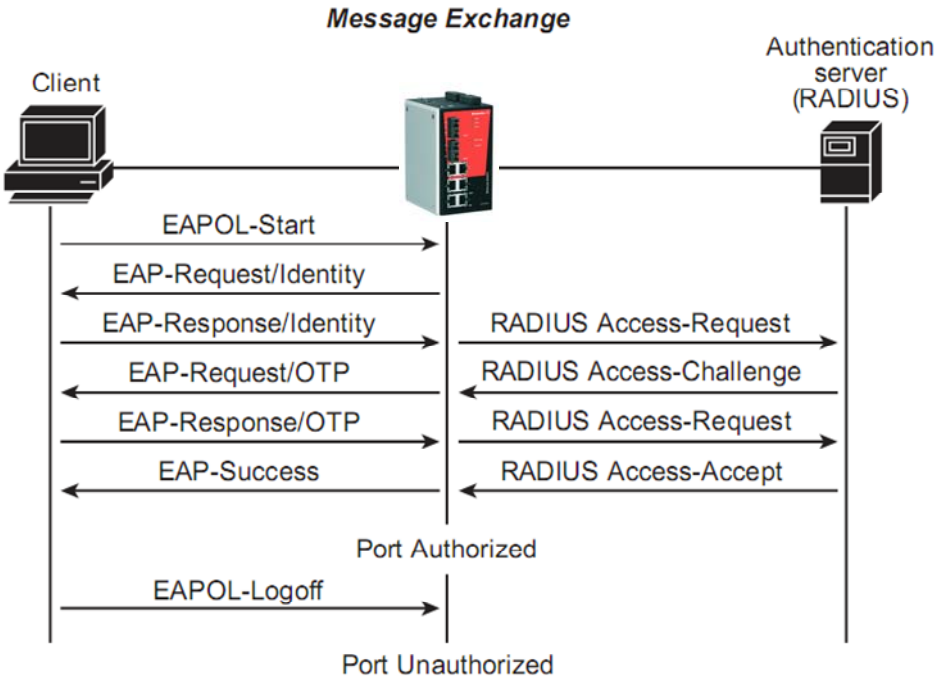
Supplicant: The end station that requests access to the LAN and switch services and responds to the requests from the switch.

Authentication server: The server that performs the actual authentication of the supplicant.

Authenticator: Edge switch or wireless access point that acts as a proxy between the supplicant and the authentication server, requesting identity information from the supplicant, verifying the information with the authentication server, and relaying a response to the supplicant.

The IE-SW-PL18M acts as an authenticator in the 802.1X environment. A supplicant and an authenticator exchange EAPOL (Extensible Authentication Protocol over LAN) frames with each other. We can either use an external RADIUS server as the authentication server, or implement the authentication server in the Ethernet Switch by using a Local User Database as the authentication look-up table. When we use an external RADIUS server as the authentication server, the authenticator and the authentication server exchange EAP frames between each other.

Authentication can be initiated either by the supplicant or the authenticator. When the supplicant initiates the authentication process, it sends an "EAPOL-Start" frame to the authenticator. When the authenticator initiates the authentication process or when it receives an "EAPOL Start" frame, it sends an "EAP Request/Identity" frame to ask for the username of the supplicant. The following actions are described below:

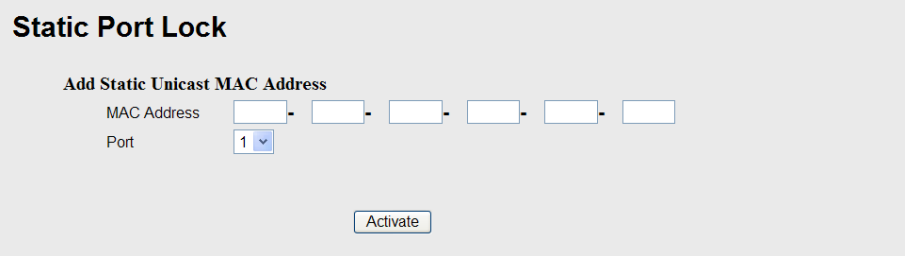


1. When the supplicant receives an "EAP Request/Identity" frame, it sends an "EAP Response/Identity" frame with its username back to the authenticator.
2. If the RADIUS server is used as the authentication server, the authenticator relays the "EAP Response/Identity" frame from the supplicant by encapsulating it into a "RADIUS Access-Request" frame and sends to the RADIUS server. When the authentication server receives the frame, it looks up its database to check if the username exists. If the username is not present, the authentication server replies with a "RADIUS Access-Reject" frame to the authenticator if the server is a RADIUS server or just indicates failure to the authenticator if the Local User Database is used. The authenticator sends an "EAP-Failure" frame to the supplicant.
3. The RADIUS server sends a "RADIUS Access-Challenge," which contains an "EAP Request" with an authentication type to the authenticator to ask for the password from the client. RFC 2284 defines several EAP authentication types, such as "MD5-Challenge," "One-Time Password," and "Generic Token Card." Currently, only "MD5-Challenge" is supported. If the Local User Database is used, this step is skipped.
4. The authenticator sends an "EAP Request/MD5-Challenge" frame to the supplicant. If the RADIUS server is used, the "EAP Request/MD5-Challenge" frame is retrieved directly from the "RADIUS Access-Challenge" frame.
5. The supplicant responds to the "EAP Request/MD5-Challenge" by sending an "EAP Response/MD5-Challenge" frame that encapsulates the user's password using the MD5 hash algorithm.

6. If the RADIUS server is used as the authentication server, the authenticator relays the "EAP Response/MD5-Challenge" frame from the supplicant by encapsulating it into a "RADIUS Access-Request" frame along with a "Shared Secret," which must be the same within the authenticator and the RADIUS server, and sends the frame to the RADIUS server. The RADIUS server checks against the password with its database, and replies with "RADIUS Access-Accept" or "RADIUS Access-Reject" to the authenticator. If the Local User Database is used, the password is checked against its database and indicates success or failure to the authenticator.
7. The authenticator sends "EAP Success" or "EAP Failure" based on the reply from the authentication server.

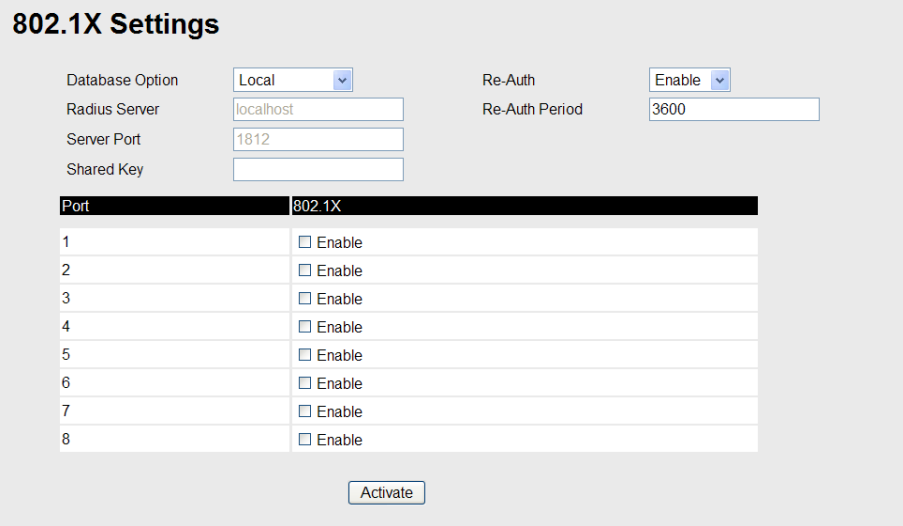
Configuring Static Port Lock

The IE-SW-PL18M supports adding unicast groups manually if required.



Setting	Description	Factory Default
MAC Address	Add the static unicast MAC address into the address table.	None
Port	Fix the static address with a dedicated port.	1

Configuring IEEE 802.1X



Database Option

Setting	Description	Factory Default
Local (Max. 32 users)	Select this option when setting the Local User Database as the authentication database.	Local
Radius	Select this option to set an external RADIUS server as the authentication database. The authentication mechanism is "EAP-MD5."	Local
Radius, Local	Select this option to make an external RADIUS server as the authentication database with first priority. The authentication mechanism is "EAP-MD5." The first priority is to set the Local User Database as the authentication database.	Local

Radius Server

Setting	Description	Factory Default
IP address or domain name	The IP address or domain name of the RADIUS server	localhost

Server Port

Setting	Description	Factory Default
Numerical	The UDP port of the RADIUS Server	1812

Shared Key

Setting	Description	Factory Default
alphanumeric (Max. 40 characters)	A key to be shared between the external RADIUS server and the IE-SW-PL18M. Both ends must be configured to use the same key.	None

Re-Auth

Setting	Description	Factory Default
Enable/Disable	Select to require re-authentication of the client after a preset time period of no activity has elapsed.	Disable

Re-Auth Period

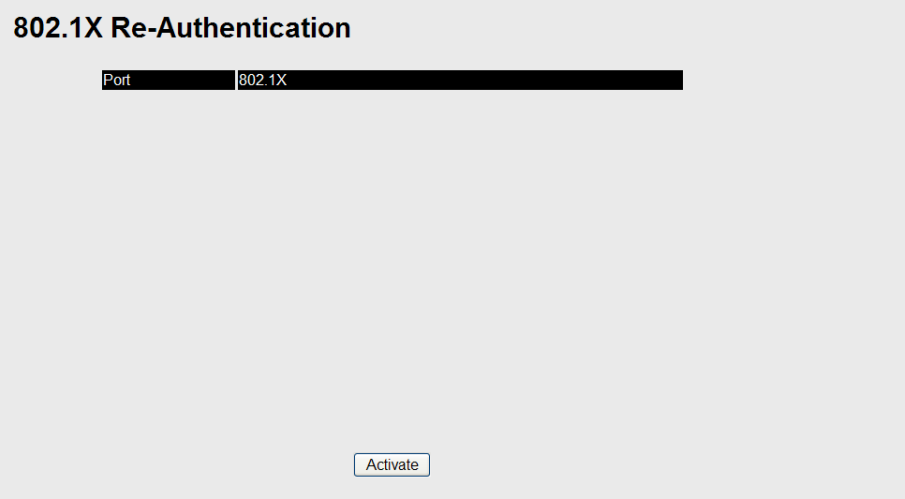
Setting	Description	Factory Default
Numerical (60-65535 sec.)	Specify how frequently the end stations need to reenter usernames and passwords in order to stay connected.	3600

802.1X

Setting	Description	Factory Default
Enable/Disable	Select the option under the 802.1X column to enable IEEE 802.1X for one or more ports. All end stations must enter usernames and passwords before access to these ports is allowed.	Disable

802.1X Re-Authentication

The IE-SW-PL18M can force connected devices to be re-authorized manually.

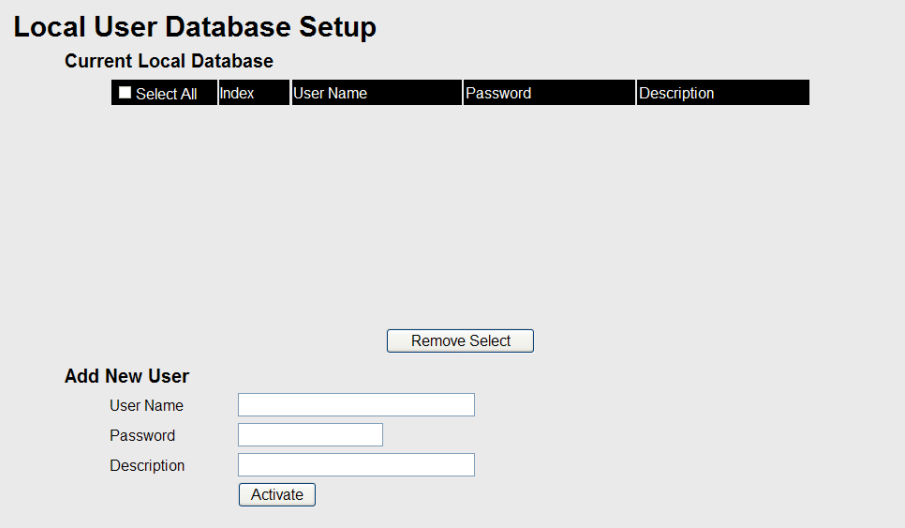


802.1X Re-Authentication

Setting	Description	Factory Default
Enable/Disable	Select the option to enable 802.1X Re-Authentication	Disable

Local User Database Setup

When setting the Local User Database as the authentication database, set the database first.

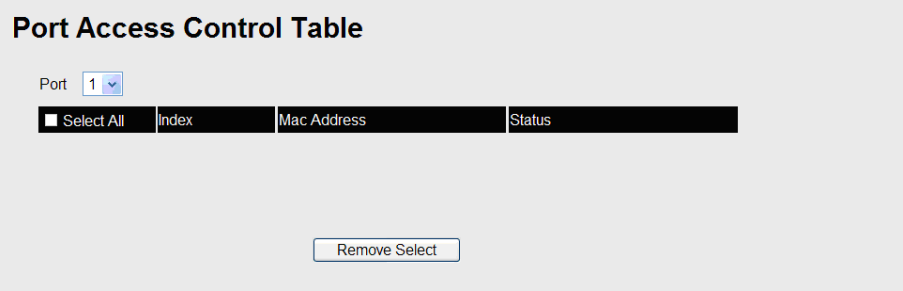


Local User Database Setup

Setting	Description	Factory Default
User Name (Max. 30 characters)	User Name for Local User Database	None
Password (Max. 16 characters)	Password for Local User Database	None
Description (Max. 30 characters)	Description for Local User Database	None

NOTE The user name for the Local User Database is case-insensitive.

Port Access Control Table



The port status will indicate whether the access is authorized or unauthorized.

Using Auto Warning

Since industrial Ethernet devices are often located at the endpoints of a system, these devices will not always know what is happening elsewhere on the network. This means that an industrial Ethernet switch that connects to these devices must provide system maintainers with real-time alarm messages. Even when control engineers are out of the control room for an extended period of time, they can still be informed of the status of devices almost instantaneously when exceptions occur. The IE-SW-PL18M supports different approaches to warn engineers automatically, such as by using email and relay output. It also supports two digital inputs to integrate sensors into your system to automate alarms using email and relay output.

Configuring Email Warning

The Auto Email Warning function uses e-mail to alert the user when certain user-configured events take place.

Three basic steps are required to set up the Auto Warning function:

Configuring Email Event Types

Select the desired **Event types** from the Console or Web Browser Event type page (a description of each event type is given later in the *Email Alarm Events setting* subsection).

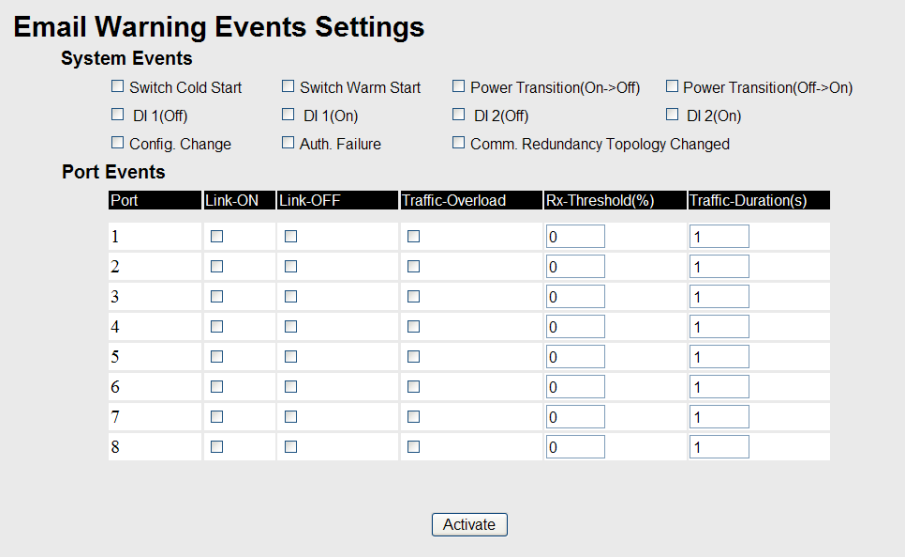
Configuring Email Settings

To configure the IE-SW-PL18M's email setup from the Console interface or browser interface, enter your Mail Server IP/Name (IP address or name), Account Name, Account Password, Retype New Password, and the email address to which warning messages will be sent.

Activate your settings and if necessary, test the email

After configuring and activating your IE-SW-PL18M's Event Types and Email Setup, you can use the **Test Email** function to see if your e-mail addresses and mail server address have been properly configured.

Event Type



Event Types can be divided into two basic groups: **System Events** and **Port Events**. System Events are related to the overall function of the switch, whereas Port Events are related to the activity of a specific port.

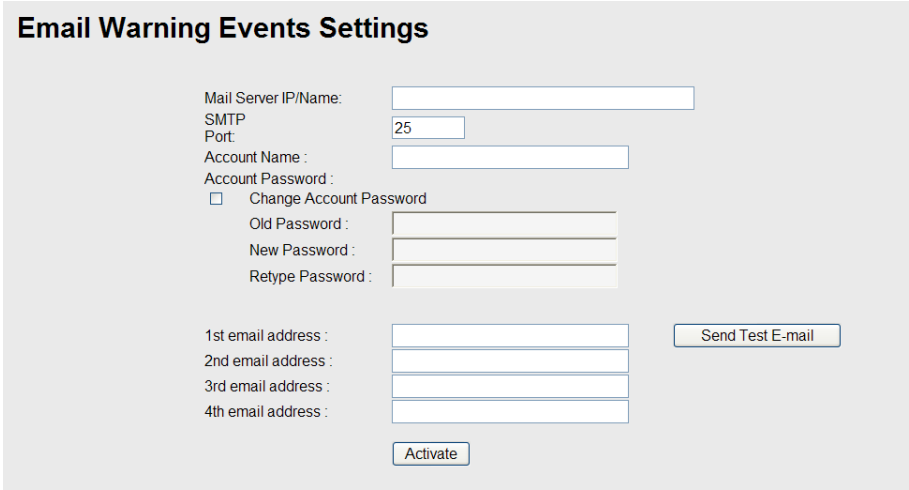
System Events	Warning e-mail is sent when…
Switch Cold Start	Power is cut off and then reconnected.
Switch Warm Start	The IE-SW-PL18M is rebooted, such as when network parameters are changed (IP address, subnet mask, etc.).
Power Transition (On→Off)	The IE-SW-PL18M is powered down.
Power Transition (Off→On)	The IE-SW-PL18M is powered up.
DI1 (On→Off)	Digital Input 1 is triggered by on to off transition
DI1 (Off→On)	Digital Input 1 is triggered by off to on transition
DI2 (On→Off)	Digital Input 2 is triggered by on to off transition
DI2 (Off→On)	Digital Input 2 is triggered by off to on transition
Configuration Change Activated	A configuration item has been changed.
Authentication Failure	An incorrect password is entered.
Comm. Redundancy Topology Changed	Spanning Tree Protocol switches have changed their position (applies only to the root of the tree). The Master of the Turbo Ring has changed or the backup path is activated.

Port Events	Warning e-mail is sent when…
Link-ON	The port is connected to another device.
Link-OFF	The port is disconnected (e.g., the cable is pulled out, or the opposing device shuts down).
Traffic-Overload	The port's traffic surpasses the Traffic-Threshold for that port (provided this item is Enabled).
Traffic-Threshold (%)	Enter a non-zero number if the port's Traffic-Overload item is Enabled.
Traffic-Duration (sec.)	A Traffic-Overload warning is sent every Traffic-Duration seconds if the average Traffic-Threshold is surpassed during that time period.

NOTE The Traffic-Overload, Traffic-Threshold (%), and Traffic-Duration (sec.) Port Event items are related. If you Enable the Traffic-Overload event, then be sure to enter a non-zero Traffic-Threshold percentage, as well as a Traffic-Duration between 1 and 300 seconds.

NOTE Warning e-mail messages will have the sender field formatted in the form:
Managed_Switch_0001@Switch_Location
Where Managed_Switch is the default Switch Name, 0001 is the IE-SW-PL18M's serial number, and Switch_Location is the default Switch Location.
Refer to the Basic Settings section to see how to modify Switch Name and Switch Location.

Email Setup



Mail Server IP/Name

Setting	Description	Factory Default
IP address	The IP Address of your email server.	None

Account Name

Setting	Description	Factory Default
Max. 45 Characters	Your email account name (typically your user name)	None

Password Setting

Setting	Description	Factory Default
Disable/Enable to change Password	To reset the Password from the Web Browser interface, click the Change password check-box, type the Old Password, type the New Password, retype the New password, and then click Activate; Max. 45 Characters.	Disable
Old Password	Type the current password when changing the password	None
New Password	Type new password when enabled to change password; Max. 45 Characters.	None
Retype Password	If you type a new password in the Password field, you will be required to retype the password in the Retype new password field before updating the new password.	None

Email Address

Setting	Description	Factory Default
Max. 30 characters	You can set up to 4 email addresses to receive alarm emails from the IE-SW-PL18M.	None

Send Test Email

After configuring the email settings, you should first click ***Activate*** to activate those settings, and then click ***Send Test Email*** to verify that the settings are correct.

NOTE Auto warning e-mail messages will be sent through an authentication protected SMTP server that supports the CRAM-MD5, LOGIN, and PLAIN methods of SASL (Simple Authentication and Security Layer) authentication mechanism.
We strongly recommend not entering your Account Name and Account Password if auto warning e-mail messages can be delivered without using an authentication mechanism.

Configuring Relay Warning

The Auto Relay Warning function uses relay output to alert the user when certain user-configured events take place. There are two basic steps required to set up the Relay Warning function:

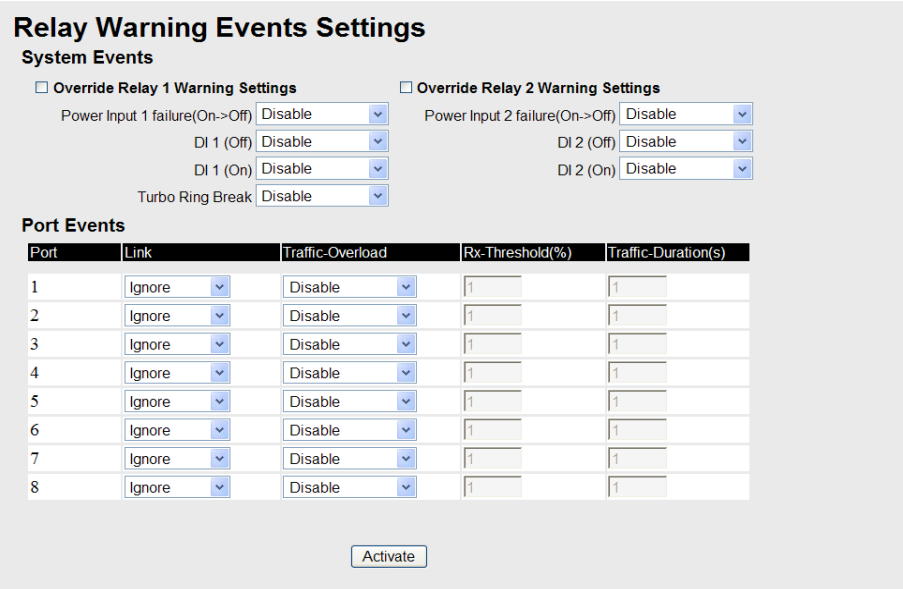
Configuring Relay Event Types

Select the desired **Event types** from the Console or Web Browser Event type page (a description of each event type is given later in the *Relay Alarm Events setting* subsection).

Activate your settings

After completing the configuration procedure, you will need to activate your IE-SW-PL18M's Relay Event Types.

Event Setup


Relay Warning Events Settings
System Events
Override Relay 1 Warning Settings
Power Input 1 failure(On->Off) Disable
DI 1 (Off) Disable
DI 1 (On) Disable
Turbo Ring Break Disable
Override Relay 2 Warning Settings
Power Input 2 failure(On->Off) Disable
DI 2 (Off) Disable
DI 2 (On) Disable
Port Events
Port Link Traffic-Overload Rx-Threshold(%) Traffic-Duration(s)
1 Ignore Disable 1 1
2 Ignore Disable 1 1
3 Ignore Disable 1 1
4 Ignore Disable 1 1
5 Ignore Disable 1 1
6 Ignore Disable 1 1
7 Ignore Disable 1 1
8 Ignore Disable 1 1
Activate

Event Types can be divided into two basic groups: **System Events** and **Port Events**. System Events are related to the overall function of the switch, whereas Port Events are related to the activity of a specific port.

The IE-SW-PL18M supports two relay outputs. You can configure which relay output is related to which events. This helps administrators identify the importance of the different events.

System Events	Warning Relay output is triggered when…
Power Transition (On→Off)	The IE-SW-PL18M is powered on.
Power Transition (Off→On)	The IE-SW-PL18M is powered down.
DI1 (On→Off)	Digital Input 1 is triggered by on to off transition
DI1 (Off→On)	Digital Input 1 is triggered by off to on transition
DI2 (On→Off)	Digital Input 2 is triggered by on to off transition
DI2 (Off→On)	Digital Input 2 is triggered by off to on transition

Port Events	Warning e-mail is sent when…
Link-ON	The port is connected to another device.
Link-OFF	The port is disconnected (e.g., the cable is pulled out, or the

	opposing device shuts down).
Traffic-Overload	The port's traffic surpasses the Traffic-Threshold for that port (provided this item is Enabled).
Traffic-Threshold (%)	Enter a non-zero number if the port's Traffic-Overload item is Enabled.
Traffic-Duration (sec.)	A Traffic-Overload warning is sent every Traffic-Duration seconds if the average Traffic-Threshold is surpassed during that time period.

NOTE The Traffic-Overload, Traffic-Threshold (%), and Traffic-Duration (sec) Port Event items are related. If you Enable the Traffic-Overload event, then be sure to enter a non-zero Traffic-Threshold percentage, as well as a Traffic-Duration between 1 and 300 seconds.

Override relay alarm settings

Select this option to override the relay warning setting temporarily. Releasing the relay output will allow administrators to fix any problems with the warning condition.

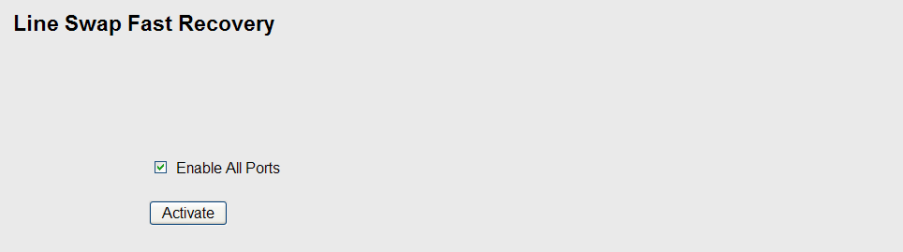
Warning List

Use this table to see if any relay alarms have been issued.

Using Line-Swap-Fast-Recovery

The Line-Swap Fast Recovery function, which is enabled by default, allows the IE-SW-PL18M to return to normal operation extremely quickly after devices are unplugged and then re-plugged into different ports. The recovery time is on the order of a few milliseconds (compare this with standard commercial switches for which the recovery time could be on the order of several minutes). To disable the Line-Swap Fast Recovery function, or to re-enable the function after it has already been disabled, access either the Console utility's **Line-Swap recovery** page, or the Web Browser interface's **Line-Swap fast recovery** page, as the following figure shows:

Configuring Line-Swap Fast Recovery



Enable Line-Swap-Fast-Recovery

Setting	Description	Factory Default
Enable/Disable	Select this option to enable the Line-Swap-Fast-Recovery function	Enable

Using Set Device IP

To reduce the effort required to set up IP addresses, the IE-SW-PL18M comes equipped with DHCP/BOOTP server and RARP protocol to set up IP addresses of Ethernet-enabled devices automatically.

When enabled, the **Set device IP** function allows The IE-SW-PL18M to assign specific IP addresses automatically to connected devices that are equIPped with *DHCP Client* or *RARP* protocol. In effect, the Ethernet Switch acts as a DHCP server by assigning a connected device with a specific IP address stored in its internal memory. Each time the connected device is switched on or rebooted, the IE-SW-PL18M sends the device the desired IP address.

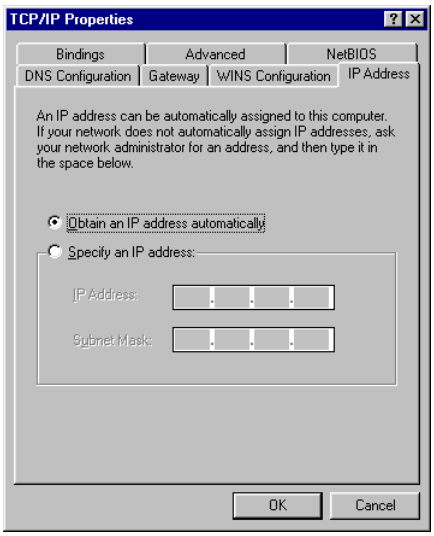
Perform the following steps to use the **Set device IP** function:

STEP 1—*Set up the connected devices*

Set up those Ethernet-enabled devices connected to the IE-SW-PL18M for which you would like IP addresses to be assigned automatically. The devices must be configured to obtain their IP address automatically.

The devices' configuration utility should include a setup page that allows you to choose an option similar to Obtain an IP address automatically.

For example, Windows' TCP/IP Properties window is shown at the right. Although your device's configuration utility may look quite a bit different, this figure should give you some idea of what to look for.


TCP/IP Properties
Bindings
Advanced
NetBIOS
DNS Configuration
Gateway
WINS Configuration
IP Address
An IP address can be automatically assigned to this computer. If your network does not automatically assign IP addresses, ask your network administrator for an address, and then type it in the space below.
Obtain an IP address automatically
Specify an IP address:
IP Address:
Subnet Mask:
OK
Cancel

You also need to decide to which of the IE-SW-PL18M's ports your Ethernet-enabled devices will be connected. You will need to set up each of these ports separately, as described in the following step.

STEP 2

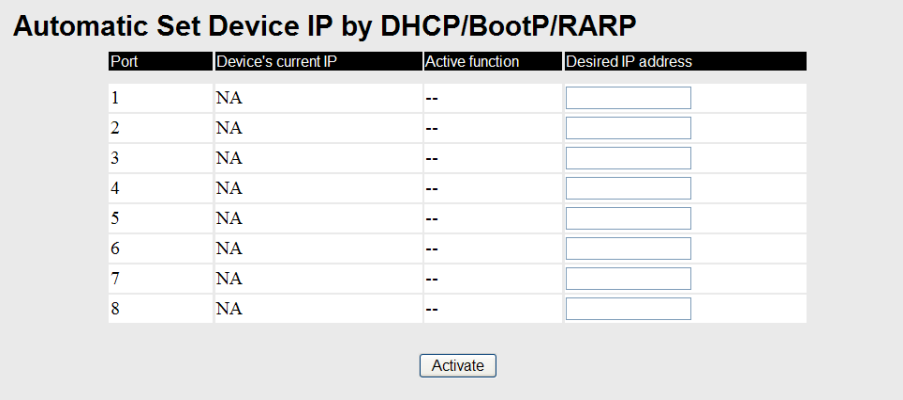
Configure the IE-SW-PL18M's **Set device IP** function, either from the Console utility or from the Web Browser interface. In either case, you simply need to enter the **Desired IP** for each port that needs to be configured.

STEP 3

Be sure to activate your settings before exiting.

- When using the Web Browser interface, activate by clicking **Activate**.
- When using the Console utility, activate by first highlighting the **Activate** menu option, and then press **Enter**. You should receive the **Set device IP settings are now active! (Press any key to continue)** message.

Configuring Set Device IP



Desired IP Address

Setting	Description	Factory Default
IP Address	Set the desired IP of connected devices.	None

The DHCP Relay Agent makes it possible for DHCP broadcast messages to be sent over routers. The DHCP Relay Agent enables DHCP clients to obtain IP addresses from a DHCP server on a remote subnet, or those that are not located on the local subnet.

DHCP Relay Agent (Option 82)

Option 82 is used by the relay agent to insert additional information into the client's DHCP request. The Relay Agent Information option is inserted by the DHCP relay agent when forwarding client-originated DHCP packets to a DHCP server. Servers can recognize the Relay Agent Information option and use the information to implement IP addresses to Clients.

When Option 82 is enabled on the switch, a subscriber device is identified by the switch port through which it connects to the network (in addition to its MAC address). Multiple hosts on the subscriber LAN can be connected to the same port on the access switch and are uniquely identified.

The Option 82 information contains 2 sub-options: Circuit ID and Remote ID, which define the relationship between end device IP and the DHCP Option 82 server. The "Circuit ID" is a 4-byte number generated by the Ethernet switch—a combination of physical port number and VLAN ID. The format of the "Circuit ID" is as described below:

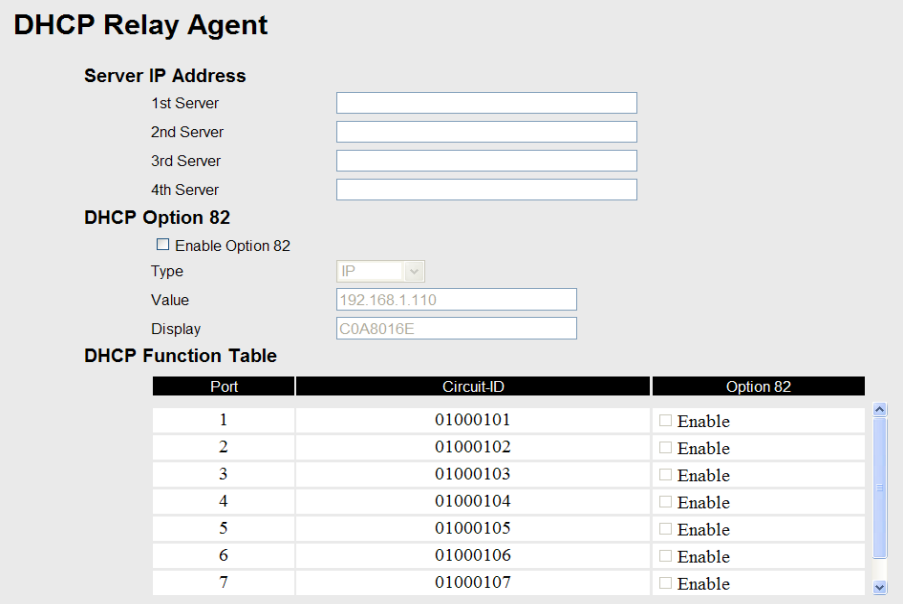
FF–VV–VV–PP

Where the first byte "FF" is fixed to "01", the second and the third byte "VV-VV" is formed by the port VLAN ID in hex, and the last byte "PP" is formed by the port number in hex. For example,

01–00–0F–03 is the "Circuit ID" of port number 3 with port VLAN ID 15.

The "Remote ID" is to identify the relay agent itself and it can be one of the following:

1. The IP address of the relay agent.
2. The MAC address of the relay agent.
3. A combination of IP address and MAC address of the relay agent.
4. A user-defined string.



Server IP Address

1st Server

Setting	Description	Factory Default
IP address for the 1st DHCP server	This assigns the IP address of the 1st DHCP server that the switch tries to access.	None

2nd Server

Setting	Description	Factory Default
IP address for the 2nd DHCP server	This assigns the IP address of the 2nd DHCP server that the switch tries to access.	None

3rd Server

Setting	Description	Factory Default
IP address for the 3rd DHCP server	This assigns the IP address of the 3rd DHCP server that the switch tries to access.	None

4th Server

Setting	Description	Factory Default
IP address for the 4th DHCP server	This assigns the IP address of the 4th DHCP server that the switch tries to access.	None

DHCP Option 82

Enable Option82

Setting	Description	Factory Default
Enable or Disable	Enable or disable DHCP Option 82 function.	Disable

Type

Setting	Description	Factory Default
IP	Use switch IP address as the remote ID sub-option.	IP
MAC	Use switch MAC address as the remote ID sub-option.	IP
Client-ID	Use the combination of switch MAC address and IP address as the remote ID sub-option.	IP
Other	Use the user-defined value as the remote ID sub-option.	IP

Value

Setting	Description	Factory Default
	Displays the value which you've set.	
Max. 12 characters	If you set the type as Other, you will have to fill it.	switch IP address

Display

Setting	Description	Factory Default
	The actual hexdecimal value set at the DHCP server for the Remote-ID. This value is automatically generated according to the Value field. Users can not modify it.	COA87FFD

DHCP Function Table

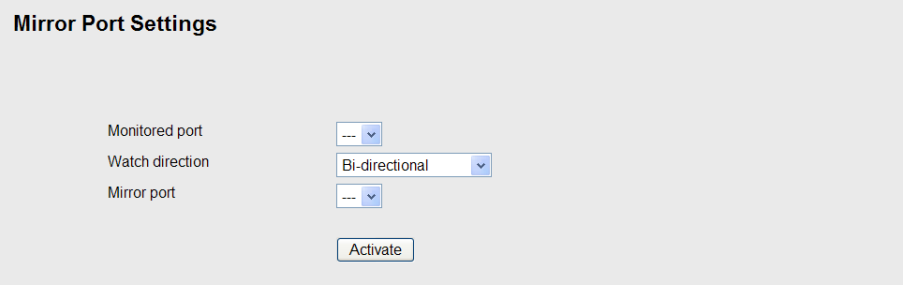
Enable

Setting	Description	Factory Default
Enable or Disable	Enable or disable DHCP Option 82 function for this port.	Disable

Using Diagnosis

The IE-SW-PL18M provides two important tools for administrators to diagnose network systems.

Mirror Port



The **Mirror port** function can be used to monitor data being transmitted through a specific port. This is done by setting up another port (the *mirror port*) to receive the same data being transmitted from, or both to and from, the port under observation. This allows the network administrator to "sniff" the observed port and thus keep tabs on network activity.

Perform the following steps to set up the **Mirror Port** function:

STEP 1

Configure the **Mirror Port** function from either the Console utility or Web Browser interface. You will need to configure three settings:

Monitored Port	Select the port number of the port whose network activity will be monitored.
Mirror Port	Select the port number of the port that will be used to monitor the activity of the monitored port.
Watch Direction	Select one of the following three watch direction options: • **Input data stream** Select this option to monitor only those data packets coming in through the IE-SW-PL18M's port. • **Output data stream** Select this option to monitor only those data packets being sent out through the IE-SW-PL18M's port.

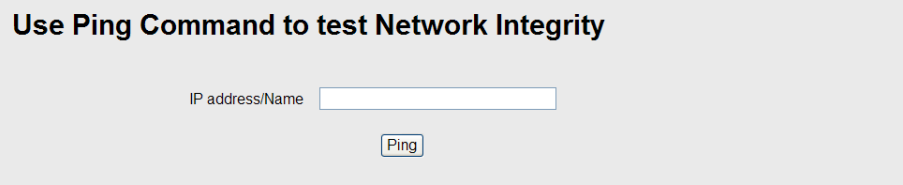
	• **Bi-directional** Select this option to monitor data packets both coming into, and being sent out through, the IE-SW-PL18M's port.

STEP 2

Be sure to activate your settings before exiting.

- When using the Web Browser interface, activate by clicking **Activate**.
- When using the Console utility, activate by first highlighting the Activate menu option, and then press **Enter**. You should receive the **Mirror port settings are now active! (Press any key to continue)** message.

Ping

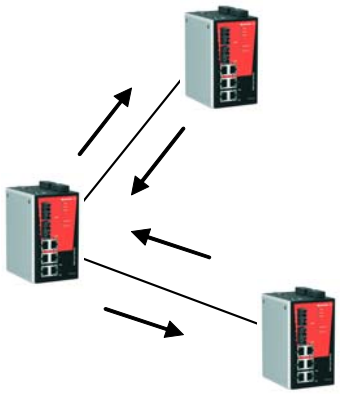


The **Ping** function uses the *ping* command to give users a simple but powerful tool for troubleshooting network problems. The function's most unique feature is that even though the ping command is entered from the user's PC keyboard, the actual ping command originates from IE-SW-PL18M itself. In this way, the user can essentially control the Ethernet Switch and send ping commands out through its ports.

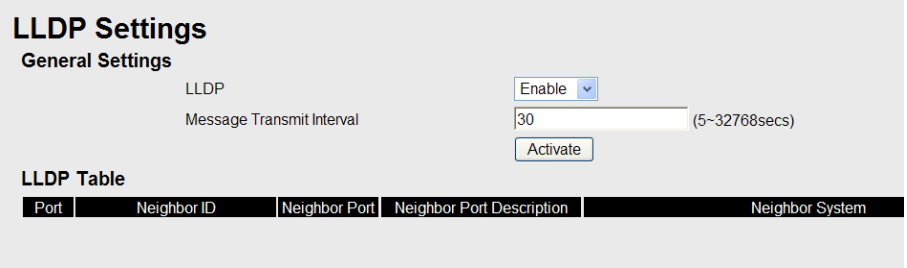
To use the Ping function, type in the desired IP address, and then press **Enter** from the Console utility, or click **Ping** when using the Web Browser interface.

LLDP Function Overview

Defined by IEEE 802.11AB, LLDP is an OSI Layer 2 Protocol that standardizes the methodology of self-identity advertisement. It allows each networking device, e.g. a Weidmüller managed switch, to periodically inform its neighbors about its self-information and configurations. As a result, all of the devices would have knowledge about each other; and through SNMP, this knowledge can be transferred to a Network Management Software for auto-topology and network visualization.



LLDP Web Interface



From the switch's web interface, users have the option of either enabling or disabling the LLDP, as well as setting the LLDP transmit interval (as shown in the figure below). In addition, users are able to view each switch's neighbor-list, which is reported by its network neighbors. Most importantly, enabling the LLDP function allows a Network Management Software to automatically display the network's topology as well as system setup details such asVLAN, and Trunking for the entire network.

LLDP Settings

Enable LLDP

Setting	Description	Factory Default
Enable or Disable	Enable or disable LLDP function.	Enable

Value

Setting	Description	Factory Default
Numbers from 5 to 32768 secs	To set the transmit interval of LLDP messages. Unit is in seconds.	30 (seconds)

LLDP Table

Port	Neighbor ID	Neighbor Port	Neighbor Port Description	Neighbor System

Port: The port number that connects to the neighbor device.

Neighbor ID: A unique entity which identifies a neighbor device; this is typically the MAC address.

Neighbor Port: The port number of the neighbor device.

Neighbor Port Description: A textual description of the neighbor device's interface.

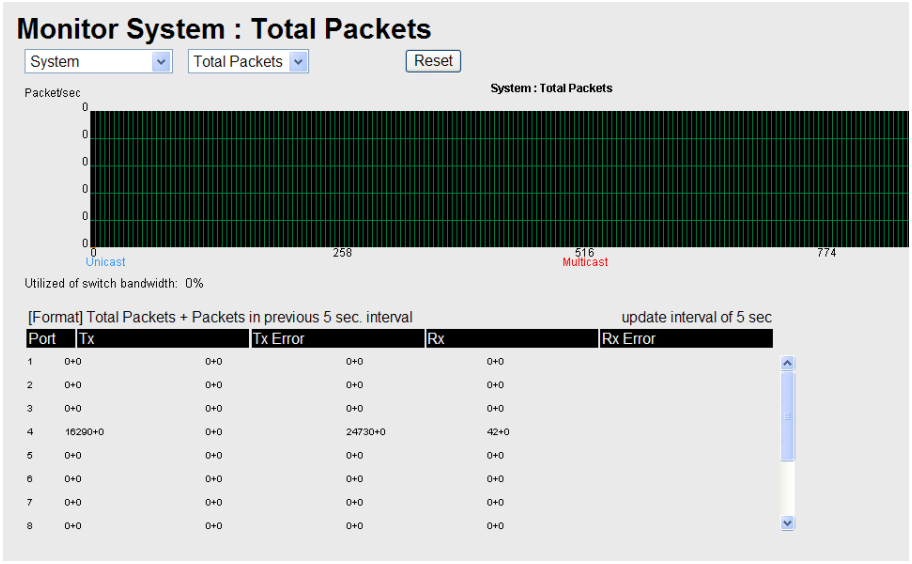
Neighbor System: Hostname of the neighbor device.

Using Monitor

You can monitor statistics in real time from the IE-SW-PL18M's web console and serial console.

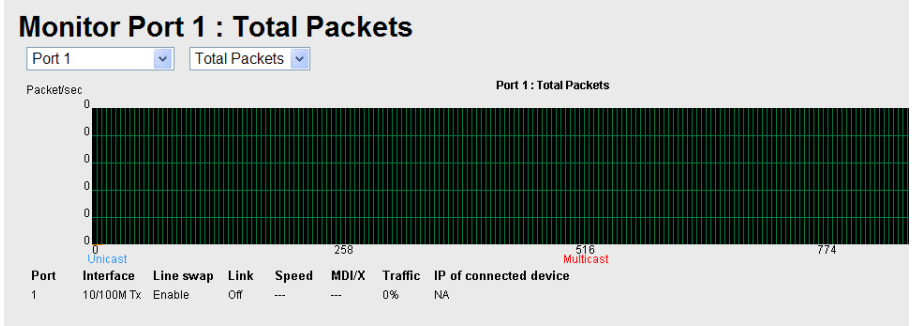
Monitor by Switch

Access the Monitor by selecting "System" from the left selection bar. Monitor by System allows the user to view a graph that shows the combined data transmission activity of all of the IE-SW-PL18M's ports. Click one of the four options—**Total Packets**, **TX Packets**, **RX Packets**, or **Error Packets**—to view transmission activity of specific types of packets. Recall that TX Packets are packets sent out from the IE-SW-PL18M, RX Packets are packets received from connected devices, and Error Packets are packets that did not pass TCP/IP's error checking algorithm. The Total Packets option displays a graph that combines TX, RX, and TX Error, RX Error Packets activity. The graph displays data transmission activity by showing **Packets/s** (i.e., packets per second, or pps) versus **sec.** (seconds). In fact, three curves are displayed on the same graph: **Unicast** packets (in red color), **Multicast** packets (in green color), and **Broadcast** packets (in blue color). The graph is updated every few seconds, allowing the user to analyze data transmission activity in real-time.



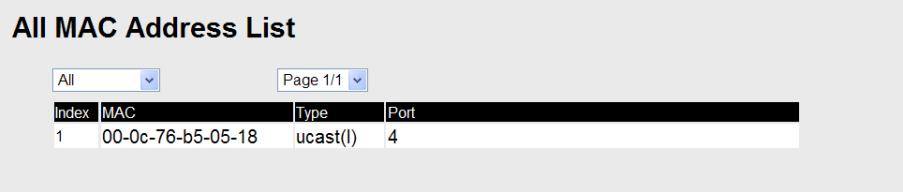
Monitor by Port

Access the Monitor by Port function by selecting **ALL 10/100M or 1G Ports, or Port *i***, in which ***i*= 1, 2, …, G2** from the left pull-down list. The **Port *i*** options are identical to the Monitor by System function discussed above, in that users can view graphs that show All Packets, TX Packets, RX Packets, or Error Packets activity, but in this case, only for an individual port. The **All Ports** option is essentially a graphical display of the individual port activity that can be viewed with the Console Monitor function discussed above. The All Ports option shows three vertical bars for each port. The height of the bar represents **Packets/s** for the type of packet, at the instant the bar is being viewed. That is, as time progresses, the height of the bar moves up or down so that the user can view the change in the rate of packet transmission. The blue colored bar shows **Unicast** packets, the red colored bar shows **Multicast** packets, and the orange colored bar shows **Broadcast** packets. The graph is updated every few seconds, allowing the user to analyze data transmission activity in real-time.



Using the MAC Address Table

This section explains the information provided by the IE-SW-PL18M's MAC address table.



The MAC Address table can be configured to display the following IE-SW-PL18M MAC address groups.

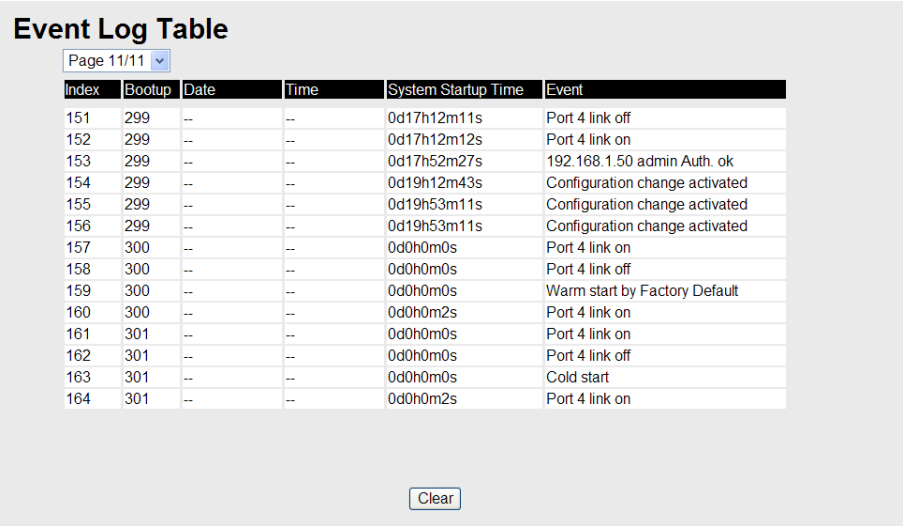
ALL	Select this item to show all IE-SW-PL18M MAC addresses
ALL Learned	Select this item to show all IE-SW-PL18M Learned MAC addresses
ALL Static Lock	Select this item to show all IE-SW-PL18M Static Lock MAC addresses
ALL Static	Select this item to show all IE-SW-PL18M Static/Static Lock /Static Multicast MAC addresses
ALL Static Multicast	Select this item to show all IE-SW-PL18M Static Multicast MAC addresses
Port x	Select this item to show all MAC addresses of dedicated ports

The table will display the following information:

MAC	This field shows the MAC address
Type	This field shows the type of this MAC address
Port	This field shows the port that this MAC address belongs to

Using System Log

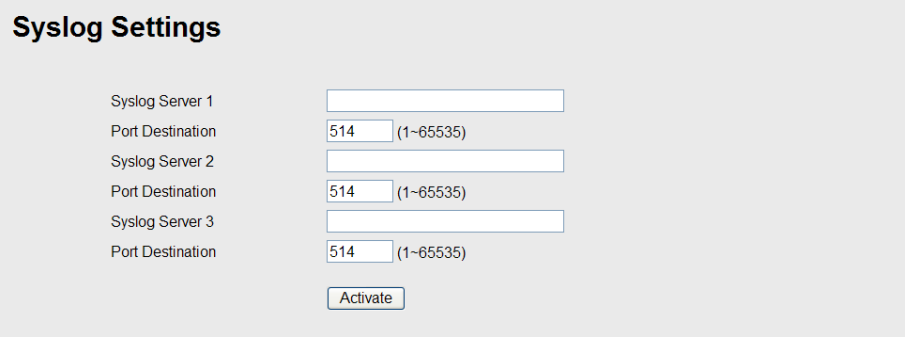
Event Log


Event Log Table
Page 11/11
Index Bootup Date Time System Startup Time Event
151 299 -- -- 0d17h12m11s Port 4 link off
152 299 -- -- 0d17h12m12s Port 4 link on
153 299 -- -- 0d17h52m27s 192.168.1.50 admin Auth. ok
154 299 -- -- 0d19h12m43s Configuration change activated
155 299 -- -- 0d19h53m11s Configuration change activated
156 299 -- -- 0d19h53m11s Configuration change activated
157 300 -- -- 0d0h0m0s Port 4 link on
158 300 -- -- 0d0h0m0s Port 4 link off
159 300 -- -- 0d0h0m0s Warm start by Factory Default
160 300 -- -- 0d0h0m2s Port 4 link on
161 301 -- -- 0d0h0m0s Port 4 link on
162 301 -- -- 0d0h0m0s Port 4 link off
163 301 -- -- 0d0h0m0s Cold start
164 301 -- -- 0d0h0m2s Port 4 link on
Clear

Bootup	This field shows how many times the IE-SW-PL18M has been rebooted or cold started.
Date	The date is updated based on how the current date is set in the "Basic Setting" page.
Time	The time is updated based on how the current time is set in the "Basic Setting" page.
System Startup Time	The system startup time related to this event.
Events	Events that have occurred.

Syslog Settings

This function provides the event logs for the syslog server. The function supports 3 configurable syslog servers and syslog server UDP port numbers. When an event occurs, the event will be sent as a syslog UDP packet to the specified syslog servers.



Syslog Server 1

Setting	Description	Factory Default
IP Address	Enter the IP address of 1st Syslog Server used by your network.	None
Port Destination (1 to 65535)	Enter the UDP port of 1st Syslog Server.	514

Syslog Server 2

Setting	Description	Factory Default
IP Address	Enter the IP address of 2nd Syslog Server used by your network.	None
Port Destination (1 to 65535)	Enter the UDP port of 2nd Syslog Server.	514

Syslog Server 3

Setting	Description	Factory Default
IP Address	Enter the IP address of 3rd Syslog Server used by your network.	None
Port Destination (1 to 65535)	Enter the UDP port of 3rd Syslog Server.	514

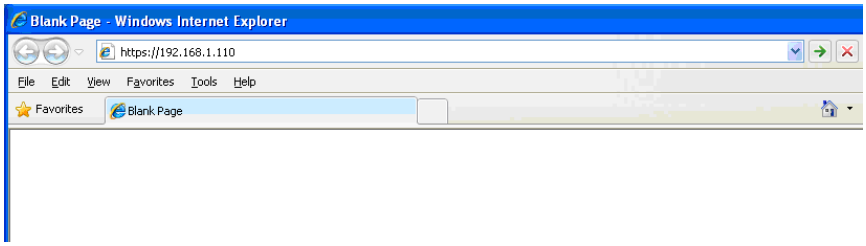
NOTE The following events will be recorded into the IE-SW-PL18M's Event Log table, and will then be sent to the specified Syslog Server:

1. Cold start
2. Warm start
3. Configuration change activated
4. Power 1/2 transition (Off (On), Power 1/2 transition (On (Off)
5. Authentication fail
6. Topology changed
7. Master setting is mismatched
8. DI 1/2 transition (Off (On), DI 1/2 transition (On (Off)
9. Port traffic overload
10. dot1x Auth Fail
11. Port link off / on

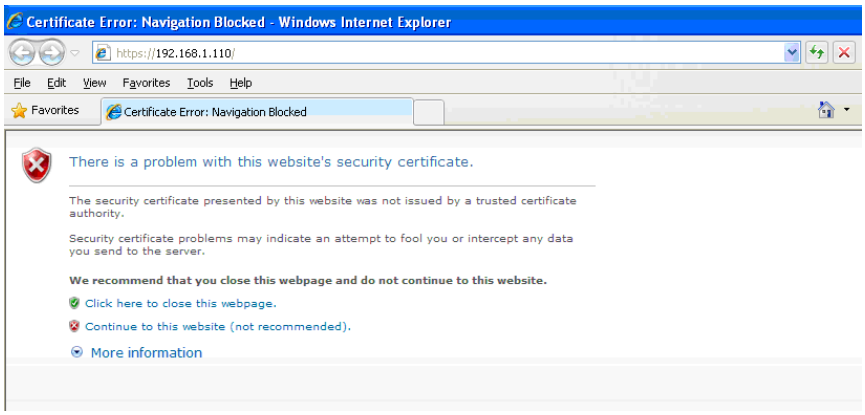
Using HTTPS/SSL

To secure your HTTP access, the IE-SW-PL18M supports HTTPS/SSL to encrypt all HTTP traffic. Perform the following steps to access the IE-SW-PL18M's web browser interface via HTTPS/SSL.

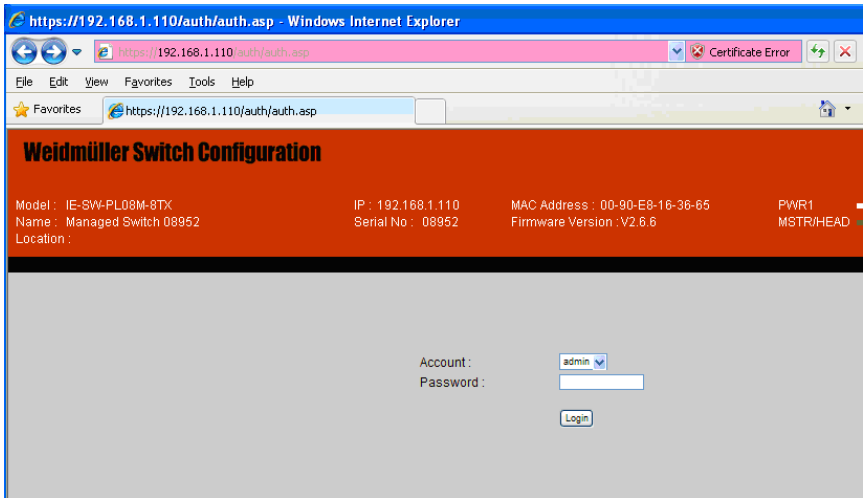
1. Open Internet Explorer and type **https://IE-SW-PL18M's IP address** in the address field. Press Enter to establish the connection.



2. Warning messages will pop out to warn the user that the security certificate was issued by a company they have not chosen to trust.


Certificate Error: Navigation Blocked - Windows Internet Explorer
https://192.168.1.110/
File Edit View Favorites Tools Help
Favorites
Certificate Error: Navigation Blocked
There is a problem with this website's security certificate.
The security certificate presented by this website was not issued by a trusted certificate authority.
Security certificate problems may indicate an attempt to fool you or intercept any data you send to the server.
We recommend that you close this webpage and do not continue to this website.
Click here to close this webpage.
Continue to this website (not recommended).
More information

3. Select **Continue to this website** to enter the Ethernet Switch web browser interface and access the web browser interface secured via HTTPS/SSL.



NOTE Weidmüller provides a Root CA certificate .After installing this certificate into your PC or notebook, you can access the web browser interface directly and will not see any warning messages again. You may download the certificate from the IE-SW-PL18M's CD-ROM.

4

Weidmüller Switch Configuration Utility

The Weidmüller Switch configuration utility (WM_Switch_Utility.exe) is a comprehensive Windows-based GUI that can be used to configure and maintain multiple Weidmüller managed switches.

A suite of useful functions is available to help you

→ to locate Ethernet Switches which are attached to the same LAN as the PC host (regardless of whether or not you know the IP addresses of the switches),

→ to connect to an Ethernet Switch whose IP address is known,

→ to modify the network configurations of one or multiple Ethernet Switches

→ and to update the firmware of one or more Ethernet Switches.

The Weidmüller Switch Configuration Utility is designed to provide you with instantaneous control of your Ethernet Switches regardless of location. You may download the Weidmüller Switch Configuration Utility software from Weidmüller's website free of charge.

The following topics are covered in this chapter:

- **Starting Weidmüller Switch Configuration Utility**
- **Broadcast Search**
- **Search by IP address**
- **Upgrade Firmware**
- **Modify IP Address**
- **Export Configuration**
- **Import Configuration**
- **Unlock the Ethernet Switch**

Starting Weidmüller Switch Configuration Utility

To start the Weidmüller Switch Configuration Utility, locate and then run the executable file **WM_Switch_Utility.exe**.

.

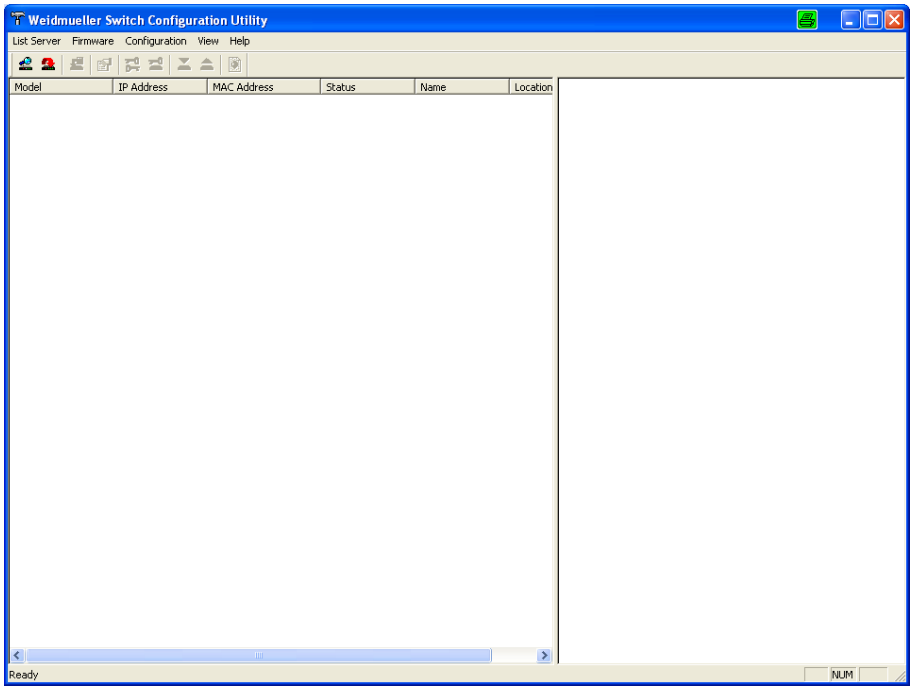
NOTE You may download the Weidmüller Switch Configuration Utility from the Weidmüller website using the following path:

1. Open www.Weidmueller.com/Downloads
2. Select page “Software”
3. Select page “Industrial Ethernet”
4. Select category “Value and Premium Line managed Switches – Software Tools”

Download “Weidmueller Switch Configuration Utility”

For example, if the file was placed on the Windows desktop, it should appear as follows. Simply double click on the icon to run the program.

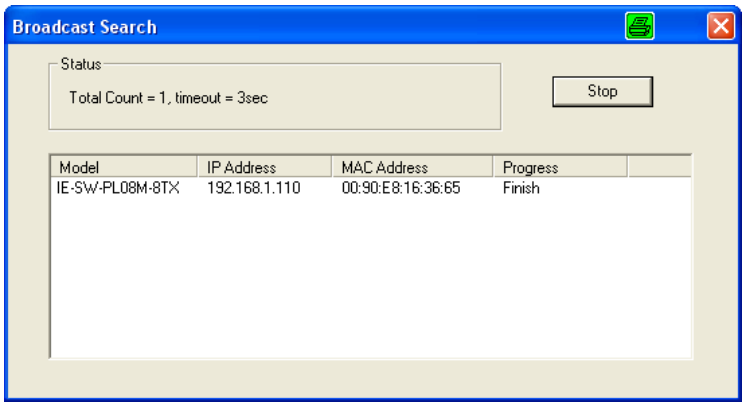
The Weidmüller Switch Configuration Utility window will open, as shown below.



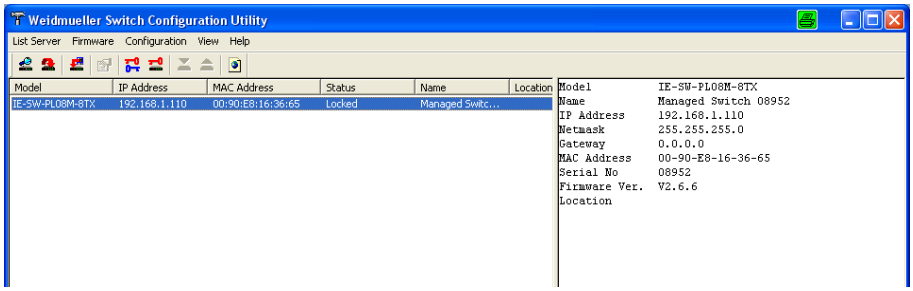
Broadcast Search

Use the Broadcast Search utility to search the LAN for all Weidmüller managed switches that are connected to the LAN. Note that since the search is done by MAC address, Broadcast Search will not be able to locate Weidmüller Ethernet Switches connected outside the PC host's LAN. Start by clicking the Broadcast Search icon , or by selecting **Broadcast Search** under the **List Server** menu.

The Broadcast Search window will open, displaying a list of all switches located on the network, as well as the progress of the search.



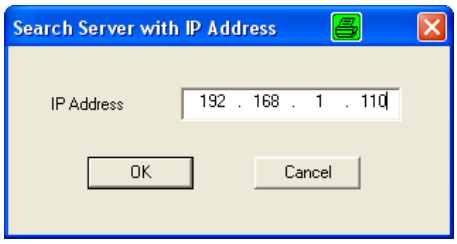
Once the search is complete, the Utility window will display a list of all switches that were located.



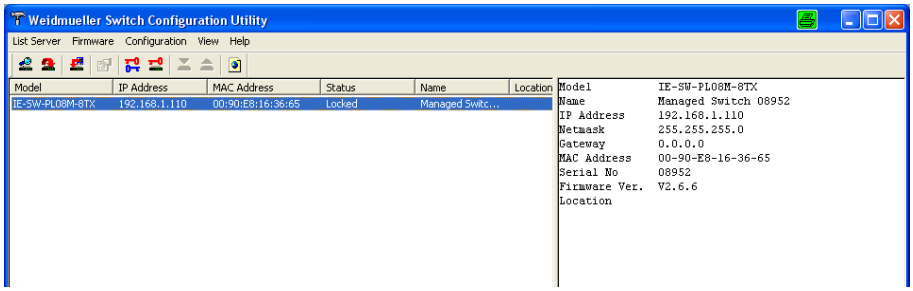
Search by IP address

This utility is used to search for IE-SW-PL18M switches one at a time. Note that the search is conducted by IP address, so you should be able to locate any IE-SW-PL18M that is properly connected to your LAN, WAN, or even the Internet. Start by clicking the Specify by IP address icon , or by selecting **Specify IP address** under the **List Server** menu.

The **Search Server with IP Address** window will open. Enter the IP address of the switch you wish to search for, and then click **OK**.



Once the search is complete, the Utility window will add the switch to the list of switches.



Upgrade Firmware

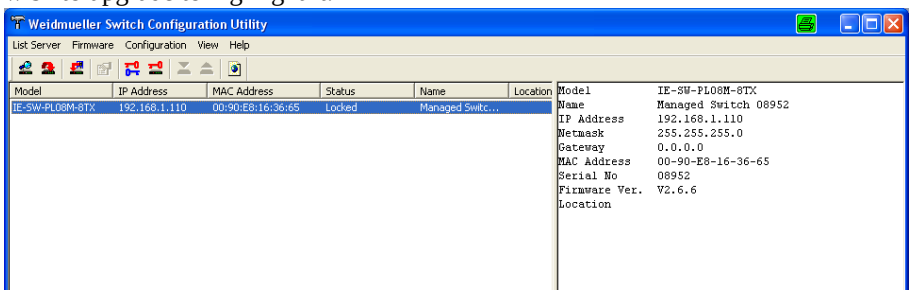
NOTE You may download the latest Firmware from the Weidmüller website using the following path:

1. Open www.Weidmueller.com/Downloads
2. Select page “Software”
3. Select page “Industrial Ethernet”
4. Select category “Value and Premium Line managed Switches – Firmware Updates”
5. Select the entry “IE-SW-PL18M-Series” for Firmware download

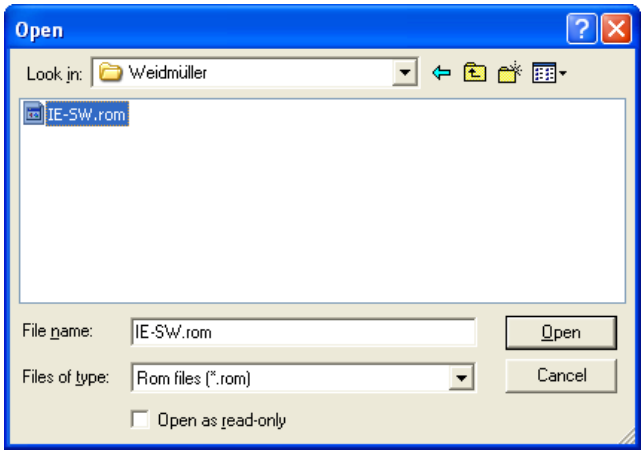
Note: The unzipped Firmware file has the extension *.rom

Keep your IE-SW-PL18M up to date with the latest firmware from Weidmüller. Perform the following steps to upgrade the firmware:

1. Download the updated firmware (*.rom) file from the Weidmüller website (www.weidmueller.com).
2. Click the switch (from the **Weidmüller Switch Configuration Utility** window) whose firmware you wish to upgrade to highlight it.



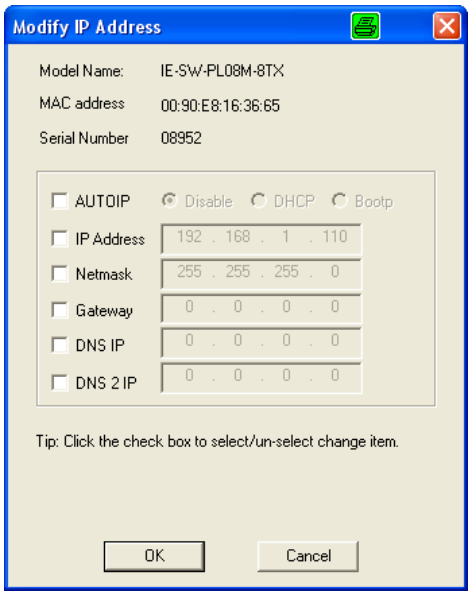
3. Click the **Upgrade Firmware** toolbar icon, or select **Upgrade** under the **Firmware** menu. If the switch is Locked, you will be prompted to input the switch's User Name and Password.
4. Use the **Open** window to navigate to the folder that contains the firmware upgrade file, and then click the correct "*.rom" file (**IE-SW.rom** in the example shown below) to select the file. Click **Open** to activate the upgrade process.



Modify IP Address

You may use the Modify IP Address function to reconfigure the IE-SW-PL18M's network settings. Start by clicking the Modify IP address icon, or by selecting **Modify IP address** under the **Configuration** menu.

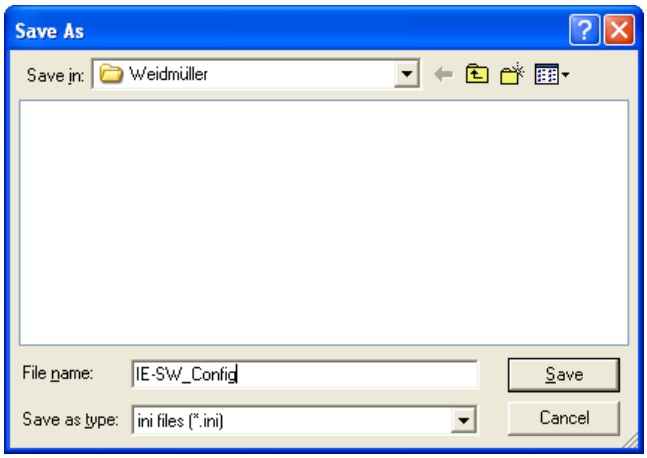
The **Setup Configuration** window will open. Checkmark the box to the left of those items that you wish to modify, and then Disable or Enable DHCP, and enter IP Address, Subnet mask, Gateway, and DNS IP. Click **OK** to accept the changes to the configuration.


Modify IP Address
Model Name: IE-SW-PL08M-8TX
MAC address 00:90:E8:16:36:65
Serial Number 08952
AUTOIP Disable DHCP Bootp
IP Address 192 . 168 . 1 . 110
Netmask 255 . 255 . 255 . 0
Gateway 0 . 0 . 0 . 0
DNS IP 0 . 0 . 0 . 0
DNS 2 IP 0 . 0 . 0 . 0
Tip: Click the check box to select/un-select change item.
OK
Cancel

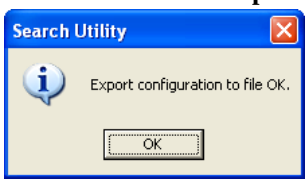
Export Configuration

The **Export Configuration** utility is used to save the entire configuration of a particular IE-SW-PL18M to a text file. Take the following steps to export a configuration:

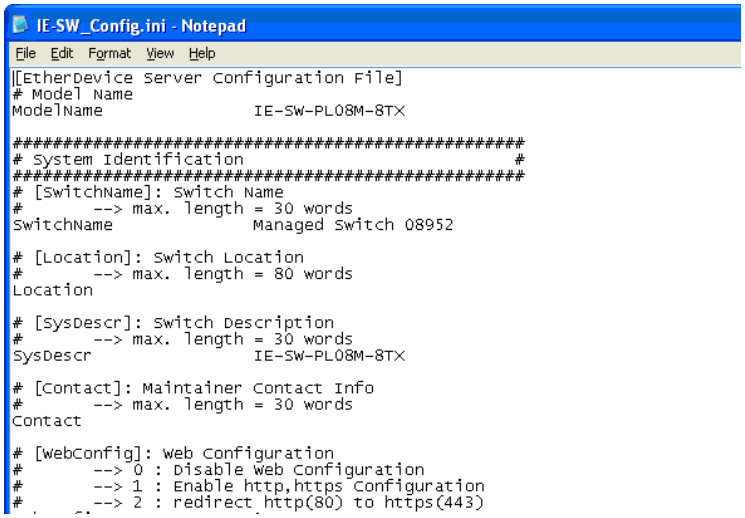
1. Highlight the switch (from the Server list in the Utility window's left pane), and then click the **Export** toolbar icon or select **Export Configuration** from the **Configuration** menu. Use the **Open** window to navigate to the folder in which you want to store the configuration, and then type the name of the file in the File name input box. Click **Save**.



2. Click **OK** when the **Export configuration to file OK** message appears.



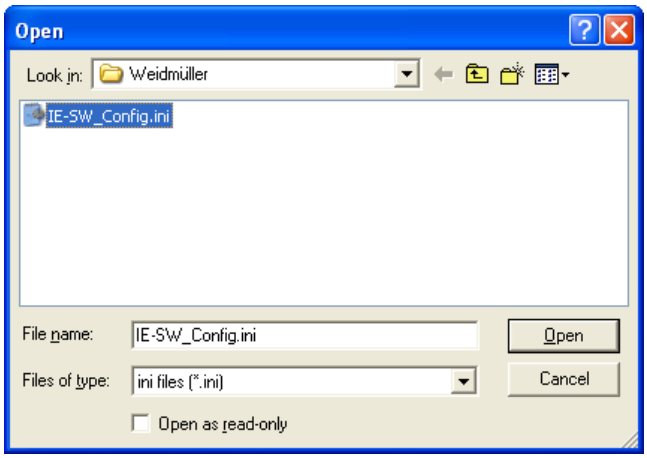
3. You may use a standard text editor, such as Notepad under Windows, to view and modify the newly created configuration file.


IE-SW_Config.ini - Notepad
File Edit Format View Help
[EtherDevice Server Configuration File]
Model Name
ModelName IE-SW-PL08M-8TX
##
System Identification
##
[SwitchName]: Switch Name
--> max. length = 30 words
SwitchName Managed Switch 08952
[Location]: Switch Location
--> max. length = 80 words
Location
[SysDescr]: Switch Description
--> max. length = 30 words
SysDescr IE-SW-PL08M-8TX
[Contact]: Maintainer Contact Info
--> max. length = 30 words
Contact
[WebConfig]: Web Configuration
--> 0 : Disable Web Configuration
--> 1 : Enable http,https Configuration
--> 2 : redirect http(80) to https(443)

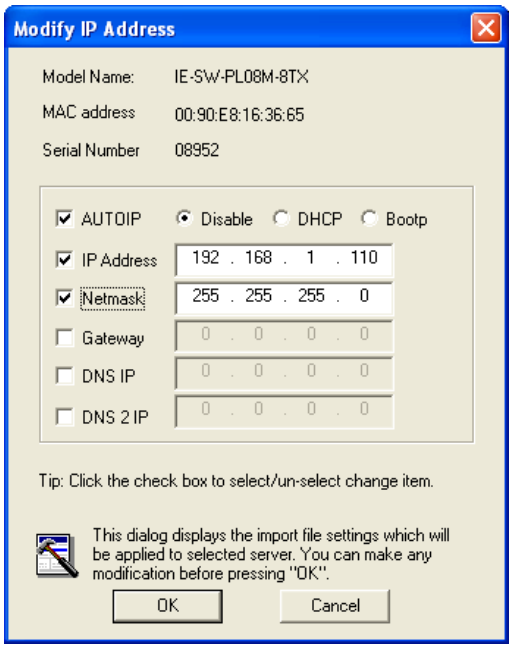
Import Configuration

The **Import Configuration** function is used to import an entire configuration from a text file to the IE-SW-PL18M. This utility can be used to transfer the configuration from one IE-SW-PL18M to another, by first using the Export Configuration function (described in the previous section) to save a switch configuration to a file, and then using the Import Configuration function. Perform the following steps to import a configuration:

1. Highlight the switch (from the Ethernet Switch list in the Utilityr window's left pane), and then click the **Import** toolbar icon, or select **Import Configuration** from the **Configuration** menu.
2. Use the **Open** window to navigate to the text file that contains the desired configuration. Once the file is selected, click **Open** to initiate the import procedure.



3. The **Setup Configuration** window will be displayed, with a special note attached at the bottom. Parameters that have been changed will be activated with a checkmark. You may make more changes if necessary, and then click **OK** to accept the changes.


Modify IP Address
Model Name: IE-SW-PL08M-8TX
MAC address 00:90:E8:16:36:65
Serial Number 08952
AUTOIP Disable DHCP Bootp
IP Address 192 . 168 . 1 . 110
Netmask 255 . 255 . 255 . 0
Gateway 0 . 0 . 0 . 0
DNS IP 0 . 0 . 0 . 0
DNS 2 IP 0 . 0 . 0 . 0
Tip: Click the check box to select/un-select change item.
This dialog displays the import file settings which will be applied to selected server. You can make any modification before pressing "OK".
OK
Cancel

4. Click **Yes** in response to the following warning message to accept the new settings.

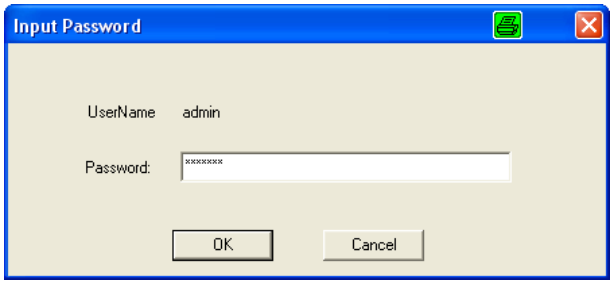
Search Utility
Warning!
Some or all of your Industrial Ethernet Switch's own network settings have been changed.
Once the new settings have been updated,you may need to use the new network settings
(IP address, Netmask, Gateway, etc.) to re-establish a Console session with your Industrial Ethernet Switch. Would you like to update network setting now ?
Ja
Nein

Unlock the Ethernet Switch

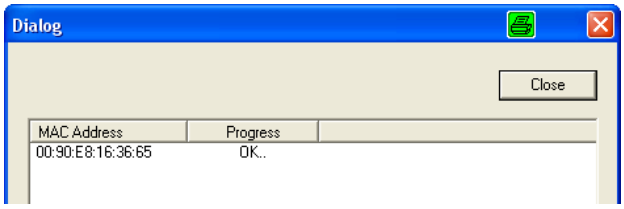
The Unlock function is used to open a password protected switch so that the user can modify its configuration, import/export a configuration, etc.

Follow the steps given below to unlock a locked IE-SW-PL18M (i.e., an IE-SW-PL18M with Status "Locked" or "Locked Fixed"). Highlight the switch (from the Ethernet Switch list in the Utility window's left pane), and then click the **Unlock** toolbar icon, or select **Unlock** from the **Configuration** menu.

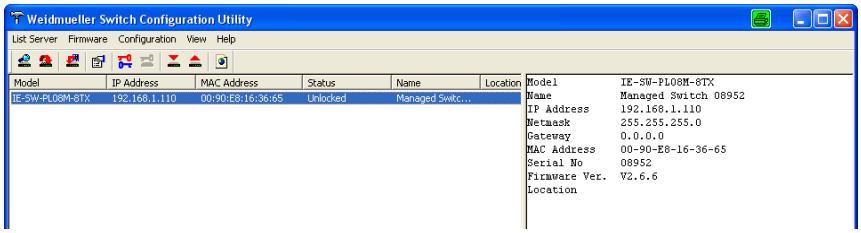
1. Enter the switch's **User Name** and **Password** when prompted, and then click **OK**.



2. When the **Dialog** window reports Progress as **OK**, click the **Close** button in the upper right corner of the window.



3. The status of the switch will now read either **Unlocked** or **Unlocked Fixed**.



A

MIB Groups

The IE-SW-PL18M comes with built-in SNMP (Simple Network Management Protocol) agent software that supports cold/warm start trap, line up/down trap, and RFC 1213 MIB-II.

The standard MIB groups supported by the IE-SW-PL18M are:

MIB II.1 – System Group

sysORTable

MIB II.2 – Interfaces Group

ifTable

MIB II.4 – IP Group

ipAddrTable
ipNetToMediaTable
IpGroup
IpBasicStatsGroup
IpStatsGroup

MIB II.5 – ICMP Group

IcmpGroup
IcmpInputStatus
IcmpOutputStats

MIB II.6 – TCP Group

tcpConnTable
TcpGroup
TcpStats

MIB II.7 – UDP Group

udpTable
UdpStats

MIB II.10 – Transmission Group

dot3
dot3StatsTable

MIB II.11 – SNMP Group

SnmpBasicGroup
SnmpInputStats
SnmpOutputStats

MIB II.17 – dot1dBridge Group

dot1dBase
    dot1dBasePortTable
dot1dStp
    dot1dStpPortTable
dot1dTp
    dot1dTpFdbTable

- dot1dTpPortTable
- dot1dTpHCPortTable
- dot1dTpPortOverflowTable

pBridgeMIB
- dot1dExtBase
- dot1dPriority
- dot1dGarp

qBridgeMIB
- dot1qBase
- dot1qTp
  - dot1qFdbTable
  - dot1qTpPortTable
  - dot1qTpGroupTable
  - dot1qForwardUnregisteredTable
- dot1qStatic
  - dot1qStaticUnicastTable
  - dot1qStaticMulticastTable
- dot1qVlan
  - dot1qVlanCurrentTable
  - dot1qVlanStaticTable
  - dot1qPortVlanTable

The IE-SW-PL18M also provides a private MIB file, located in the file "IE-SW-PL18M.my" on the IE-SW-PL18M Series utility CD-ROM.

Public Traps:

1. Cold Start
2. Link Up
3. Link Down
4. Authentication Failure
5. dot1dBridge New Root
6. dot1dBridge Topology Changed

Private Traps:

1. Configuration Changed
2. Power On
3. Power Off
4. Traffic Overloaded
5. Turbo Ring Topology Changed
6. Turbo Ring Coupling Port Changed
7. Turbo Ring Master Mismatch

B

Modbus

Modbus information

Read Only Registers (Support Function Code 4) 1 Word = 2 Bytes

Address	Data Type	Description
System Information		
0x0000	1 word	Vendor ID = 0x1393
0x0001	1 word	Unit ID (Ethernet = 1)
0x0002	1 word	Product Code = 0x0001
0x0010	20 words	Vendor Name = "Weidmueller" Word 0 Hi byte = 'W' Word 0 Lo byte = 'e' Word 1 Hi byte = 'i' Word 1 Lo byte = 'd' Word 2 Hi byte = 'm' Word 2 Lo byte = 'u' Word 3 Hi byte = 'e' Word 3 Lo byte = 'l' Word 4 Hi byte = 'l' Word 4 Lo byte = 'e' Word 5 Hi byte = 'r' Word 5 Lo byte = ' ' Word 6 Hi byte = '\0' Word 6 Lo byte = '\0'
0x0030	20 words	Product Name = "IE-SW-PL18M" Word 0 Hi byte = 'I' Word 0 Lo byte = 'E' Word 1 Hi byte = '-' Word 1 Lo byte = 'S' Word 2 Hi byte = 'W' Word 2 Lo byte = '-' Word 3 Hi byte = 'P' Word 3 Lo byte = 'L' Word 4 Hi byte = '1' Word 4 Lo byte = '8' Word 5 Hi byte = 'M' Word 5 Lo byte = ' ' Word 6 Hi byte = '\0' Word 6 Lo byte = '\0'
0x0050	1 word	Product Serial Number

0x0051	2 words	Firmware Version Word 0 Hi byte = major (A) Word 0 Lo byte = minor (B) Word 1 Hi byte = release (C) Word 1 Lo byte = build (D)
0x0053	2 words	Firmware Release Date Firmware was released on 2007-05-06 at 09 o'clock Word 0 = 0x0609 Word 1 = 0x0705
0x0055	3 words	Ethernet MAC Address Ex: MAC = 00-01-02-03-04-05 Word 0 Hi byte = 0x00 Word 0 Lo byte = 0x01 Word 1 Hi byte = 0x02 Word 1 Lo byte = 0x03 Word 2 Hi byte = 0x04 Word 2 Lo byte = 0x05
0x0058	1 word	Power 1 0x0000:Off 0x0001:On
0x0059	1 word	Power 2 0x0000:Off 0x0001:On
0x005A	1 word	Fault LED Status 0x0000:No 0x0001:Yes
0x0080	1 word	DI1 0x0000:Off 0x0001:On
0x0081	1 word	DI2 0x0000:Off 0x0001:On
0x0082	1 word	DO1 0x0000:Off 0x0001:On
0x0083	1 word	DO2 0x0000:Off 0x0001:On
Port Information		
0x1000 to 0x1011	1 word	Port 1 to 18 Status 0x0000:Link down 0x0001:Link up 0x0002:Disable 0xFFFF:No port
0x1100 to 0x1111	1 word	Port 1 to 18 Speed 0x0000:10M-Half 0x0001:10M-Full 0x0002:100M-Half 0x0003:100M-Full 0x0004:1G-Half 0x0005:1G- Full 0xFFFF:No port

0x1200 to 0x1211	1 word	Port 1 to 18 Flow Ctrl 0x0000:Off 0x0001:On 0xFFFF:No port
0x1300 to 0x1311	1 word	Port 1 to 18 MDI/MDIX 0x0000:MDI 0x0001:MDIX 0xFFFF:No port
0x1400 to 0x1413 (Port 1) 0x1414 to 0x1427 (Port 2)	20 words	Port 1 to 18 Description Port Description = "100TX,RJ45." Word 0 Hi byte = '1' Word 0 Lo byte = '0' Word 1 Hi byte = '0' Word 1 Lo byte = 'T' … Word 4 Hi byte = '4' Word 4 Lo byte = '5' Word 5 Hi byte = '.' Word 5 Lo byte = '\0'
Packets Information		
0x2000 to 0x2023	2 words	Port 1 to 18 Tx Packets Ex: port 1 Tx Packets = 0x44332211 Word 0 = 4433 Word 1 = 2211
0x2100 to 0x2123	2 words	Port 1 to 18 Rx Packets Ex: port 1 Rx Packets = 0x44332211 Word 0 = 4433 Word 1 = 2211
0x2200 to 0x2223	2 words	port 1 to 18 Tx Error Packets Ex: port 1 Tx Error Packets = 0x44332211 Word 0 = 4433 Word 1 = 2211
0x2300 to 0x2323	2 words	port 1 to 18 Rx Error Packets Ex: port 1 Rx Error Packets = 0x44332211 Word 0 = 4433 Word 1 = 2211
Redundancy Information		
0x3000	1 word	Redundancy Protocol 0x0000:None 0x0001:RSTP 0x0002:Turbo Ring 0x0003:Turbo Ring V2 0x0004:Turbo Chain
0x3100	1 word	RSTP Root 0x0000:Not Root 0x0001:Root 0xFFFF:RSTP Not Enable

0x3200 to 0x3211	1 word	RSTP Port 1 to 18 Status 0x0000:Port Disabled 0x0001:Not RSTP Port 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:RSTP Not Enable
0x3300	1 word	TR Master/Slave 0x0000:Slave 0x0001:Master 0xFFFF:Turbo Ring Not Enable
0x3301	1 word	TR 1st Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding
0x3302	1 word	TR 2nd Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding
0x3303	1 word	TR Coupling 0x0000:Off 0x0001:On 0xFFFF:Turbo Ring Not Enable
0x3304	1 word	TR Coupling Port status 0x0000:Port Disabled 0x0001:Not Coupling Port 0x0002:Link Down 0x0003:Blocked 0x0005:Forwarding 0xFFFF:Turbo Ring Not Enable
0x3305	1 word	TR Coupling Control Port status 0x0000:Port Disabled 0x0001:Not Coupling Port 0x0002:Link Down 0x0003:Blocked 0x0005:Forwarding 0x0006:Inactive 0x0007:Active 0xFFFF:Turbo Ring Not Enable
0x3500	1 word	TR2 Coupling Mode 0x0000:None 0x0001:Dual Homing 0x0002:Coupling Backup 0x0003:Coupling Primary 0xFFFF:Turbo Ring V2 Not Enable

0x3501	1 word	TR2 Coupling Port Primary status (Using in Dual Homing, Coupling Backup, Coupling Primary) 0x0000:Port Disabled 0x0001:Not Coupling Port 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Not Enable
0x3502	1 word	TR2 Coupling Port Backup status (Only using in Dual Homing) 0x0000:Port Disabled 0x0001:Not Coupling Port 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Not Enable
0x3600	1 word	TR2 Ring 1 status 0x0000:Healthy 0x0001:Break 0xFFFF:Turbo Ring V2 Not Enable
0x3601	1 word	TR2 Ring 1 Master/Slave 0x0000:Slave 0x0001:Master 0xFFFF:Turbo Ring V2 Ring 1 Not Enable
0x3602	1 word	TR2 Ring 1 1st Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Ring 1 Not Enable
0x3603	1 word	TR2 Ring 1 2nd Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Ring 1 Not Enable
0x3680	1 word	TR2 Ring 2 status 0x0000:Healthy 0x0001:Break 0xFFFF:Turbo Ring V2 Ring 2 Not Enable

0x3681	1 word	TR2 Ring 2 Master/Slave 0x0000:Slave 0x0001:Master 0xFFFF:Turbo Ring V2 Ring 2 Not Enable
0x3682	1 word	TR2 Ring 2 1st Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Ring 2 Not Enable
0x3683	1 word	TR2 Ring 2 2nd Port status 0x0000:Port Disabled 0x0001:Not Redundant 0x0002:Link Down 0x0003:Blocked 0x0004:Learning 0x0005:Forwarding 0xFFFF:Turbo Ring V2 Ring 2 Not Enable
0x3700	1 word	Turbo Chain Switch Role 0x0000:Head 0x0001:Member 0x0002:Tail 0xFFFF: Turbo Chain Not Enable
0x3701	1 word	Turbo Chain 1st Port status 0x0000: Link Down 0x0001: Blocking 0x0002: Blocked 0x0003: Forwarding 0xFFFF:Turbo Ring V2 Ring 2 Not Enable
0x3702	1 word	Turbo Chain 2nd Port status 0x0000: Link Down 0x0001: Blocking 0x0002: Blocked 0x0003: Forwarding 0xFFFF:Turbo Ring V2 Ring 2 Not Enable

Memory mapping from address 0x0000 to 0x3FFF.